PERSONAL
COMPUTER NEWS
THE COMPLETE COMPUTING WEEKLY
WEEK ENDING APRIL 1st
35p

HARDWARE

PRO-TEST OF THE PRO

TI offers soft options on its new Professional

PROGRAMMING

LYNX UNLEASHED

Let loose the colours and liberate the graphics

SOFTWARE

GAMEPLAY

Battling bugs in the new beat 'em games for the Vic 20

BUYERS GUIDE

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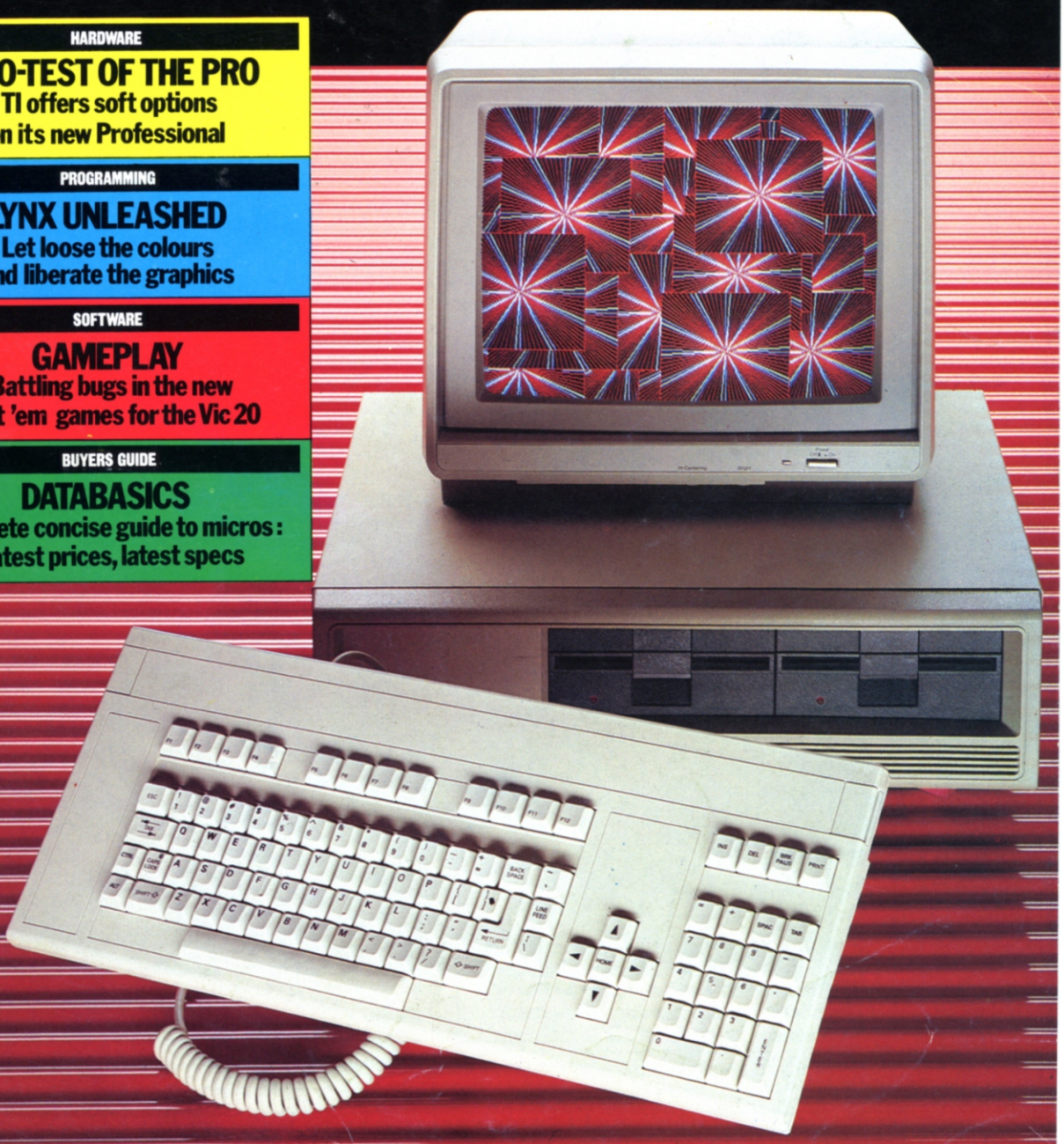
Complete concise guide to micros: latest prices, latest specs



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PCN SPECIALS

PCN Paperchase 16
Final leg in the race to win a BBC. Don't miss the closing date . . .

Splitting the Atom 24
. . . or how a good idea with the BBC Basic ROM card turned sour.

Lynx Unleashed 28
Let loose with the cat that catches colour.

Music micro please! 30
Tuning up your Apple to synthesiser quality.

PCN PRO-TESTS

Gameplay

Battle the bugs in shoot 'em up games for the Vic-20. 35

Favourites for the Dragon 32 and Spectrum. 38

Find the golden fleece on the IBM PC. 41

Hardware

Pro-Test on the Pro: full hands-on test of the Texas Instruments Professional. 42

Peripherals

Say it again SAM gives the word on a new speech synthesiser for the 48K Apple II 48

Keep your print options open with the Facit 4510 dot matrix printer 50

Change your fingertip control of the IBM 54

Software

Trial run of Petspeed — the go-faster Basic compiler. 56

Open the box and tune up your Sirius. 59

Back to pen and paper with Dragoncalc. 60

REGULARS

Monitor 2
An IBM-compatible portable makes its debut, page 2, and new lightweights are predicted from Osborne, page 3; CP/M for the Newbrain and the Lynx, page 5; independent add-ons to the Jupiter Ace, page 6 . . . in six pages of news and pictures.

Random Access 15
Your letters . . . post them to PCN and pick up £10 for the best of the week.

Routine Inquiries 18
Got a problem? Send it to Max, he'll put you right — in his weekly agony column.

Microwaves 20
Turn your tips into cash . . . we pay £5 for every helpful hint we publish.

Readout 33
What to read . . . what to leave on the shelf. Every week reviews of what's new on the bookstalls.

Program Cards 63
Nine unique cards to cut out and keep for your listings library. Games for the Vic 20 and BBC, utilities for the Spectrum . . . and more . . .

Clubnet 73
Week by week Clubnet builds into a full list of clubs and user groups throughout the country.

Datelines 73
The what, when and where of the microcomputer world.

Databasics 74
Up-to-date buyer's guide to micros — the facts at your fingertips.

PCN Billboard 83
Your marketplace . . . free readers' ads. Fill in the form and claim your space.

Cover photography of Professional by Chris Stevens.

16 bits to take away

You will soon be able to pick up the first 16-bit, IBM compatible, portable micro.

Weighing in at 29 lbs, the Computext DOT not only comes with an 8088 processor (the same as used in the IBM PC) but also twin 3½in microfloppies (another first), a built in printer and an extra wide screen.

At a starting price of £2,645 you also get 64K of RAM, another 32K of RAM dedicated to the video display and 1056 x 248 dot high resolution graphics.

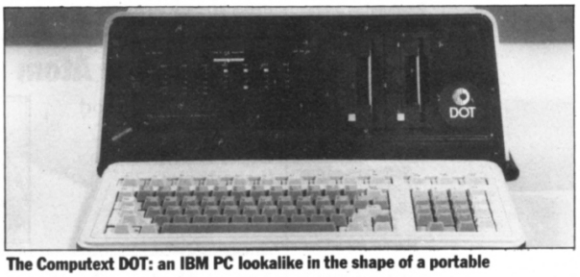
The machine may have been launched but it is not yet in the shops. 'By the end of April,' was the best estimate that Compucorp, distributors of the machine, would give.

At first glance the DOT measures up well against the Osborne.

The big plus for the DOT is its 9in stretched display. The Osborne got a lot of flak from users because of its tiny screen and wierd 52 column format.

By using 3½in microdrives instead of 5¼in disks, Compucorp has created the additional space needed for its wide screen. As a result, the DOT can offer both the 80 column and 132 column formats.

On the minus side, the DOT only offers MS-DOS and CP/M, while the Osborne includes



The Computext DOT: an IBM PC lookalike in the shape of a portable

in its £1,581 price tag lots of free software, including Wordstar and Supercalc.

Compucorp sees this as no great disadvantage. 'The DOT is compatible with the IBM PC and the DEC Rainbow,' said Dr Novick the company's managing Director.

After sales support includes on-site maintenance, which is a rare feature for micros.

Further details and the name of your nearest dealer can be obtained from Compucorp on 01-907 0198.

Great Advantage: North Star announces 16-bit upgrade

Business users thinking of upgrading to a 16-bit machine can add the North Star Advantage to their list.

North Star has done a facelift on its 8-bit machine and added a few extras to make the upgrade to a 16-bit micro.

For £4,186 you get an Intel 8088 and Z80 processor, 5Mb hard disk, one floppy disk holding 360K and 64K of RAM.

For an additional £284 you can run both the MS-DOS and CP/M operating systems.

Trader Computers, North Star distributors says the upgraded version will be available shortly.

Expanding maintenance for micros

A company that provides micro maintenance has opened up two new offices.

Beginning next week, Commercial Data Systems will maintain the Apple range, IBM PCS and the Sirius Victor in Bristol and Birmingham, as well as continuing the same service from their Essex and Lancashire offices.

The company charges 12% of a machine's recommended retail price per year, and tries to get repairs done within one working day.

CDS employs 30 engineers who are based regionally so that they can respond to calls quickly. The company has more than 2500 accounts.

The number to contact at Birmingham is 021-236 2819.

Playing with words on the IBM

Two new games for the IBM PC are now available from Pete & Pam computers.

Wordtrix is a fast-paced word game similar to Keyword, the Daily Express puzzle, but with more variation. You gain points for each new word you find, with extra points for longer words.

Quotrix involves solving a famous quote by following a series of clues.

Both retail for £19.95 plus VAT and are available direct from Pete & Pam Computers or from IBM dealers.

Pete & Pam Computers can be found at 103/5 Blegborough Road, London SW16 (tel: 01-769 1022) and New Hall, Hey Road, Rossendale, Lancs (0706-227011).

Over the Rainbow

By Ralph Bancroft

It isn't easy to find the end of the Rainbow — even one made by Digital Equipment.

Two months after its launch the DEC Rainbow is in such short supply that would-be owners may have to wait another two months before they take delivery of the machine.

Despairing dealers are advising buyers to put up with a long delay or switch to another machine.

DEC admits there are not enough machines to go round but is optimistic that the shipments it is now receiving from the US will clear the backlog by May.

'We would love to sell more machines but we don't have any to sell,' said Harry Nicolson, manager of the Microware store in Leeds. 'DEC stand to lose orders as people are switching across to the ICL personal computer.'

Not all dealers see the situation as desperate. 'It is more a thorn in our side than disastrous,' said Stuart Lakey, a director of City-based Personal Computers. 'Deliveries are slow but we now have a schedule of deliveries and we are hopeful of meeting the demand.'

Other dealers have resigned themselves to their fate. 'We accept the supply situation,' said James Wickes, a director of Beauchamp computer Systems, of West London.

He is advising people to hang on for a couple of months if they are interested in the Rainbow or DEC's other personal computer, the Professional.

DEC says the source of the problem is in the US and is due to two factors. The company underestimated the interest in the machines.

'We have now taken a major delivery this week,' a company spokesman said. 'And with further deliveries coming in every week from now on we are very optimistic that we will have caught up with the backlog by the end of April or middle of May.'

Sinclair second

Sinclair is tied for the number two position in the American micro market.

Future Computing Inc, a Dallas-based market research firm puts the Time-Sinclair 1000 (the US version of the ZX81) into second place with the venerable Apple II, each with about 600,000 machines sold.

The Commodore Vic-20 is the top micro with the largest user base in the US. Some 750,000 Vics are now in American homes.

In 1982 Timex-Sinclair and fourth-placed Texas TI99a caught up on the Apple II because these newer, cheaper machines are being marketed through mass-sales outlets.

New micros due from Osborne

Two Osborne portables that promise to make up for some of the Osborne 1's shortcomings are expected to roll off the production line in April or May.

The beefier of the new models should have a 7in amber screen with full 80-column width as opposed to the 52 column 'window' of the Osborne 1. It could also give you twice the memory, with 128K of RAM, and its twin 5¼in floppy drives are thought to be vertically aligned.

The system still runs CP/M, but if reports from the US are accurate Osborne is branching out into new areas. Its communications facilities include a built-in modem, switchable transmission speeds of 300 and 1,200 bits per second, and emulation for mainframe computer networks.

If you have a spare IBM 3081 hanging about this could be the intelligent terminal you've been waiting for.

Weighing in at 28lbs its portability may be a matter of musculature, but its smaller cousin is thought to weigh only 14lbs. This has a 5in screen, 64K RAM at your disposal, and again two disk drives.

Osborne in the UK said that the specs of future systems were still provisional. Indications from the US are that the larger machine will retail for $2,100, but this could be discounted to $1,995.

The smaller system could cost $1,795.

Portable link-up from Epson

You can now send data from your Epson HX20 over the telephone without having to set up a semi-permanent workstation first.

Norbain Micro has come up with a portable, battery-powered acoustic coupler to go with the equally portable, battery-powered Epson system.

The coupler, adapted from the Sendata 700 series, operates through the Epson's RS232 port and can transmit or receive data at 300 bits per second. It draws power from the HX20's internal supply and Norbain points out that this source makes it truly portable.

Apart from transmitting data you might well use the coupler to keep up with the latest Micronet news through the public telephone network.

Communications on the move for the HX20

Users lose as printer firm hits trouble

If you bought the £100 Amber 2400 small dot matrix printer before February 17, your one-year warranty has already run out.

Amber Controls, the company that makes the printer, has gone into receivership and the receivers say that neither they nor any company that produces the machine in the future will honour the one-year warranty promised by Amber.

But Amber managing director Dave Rayner said on Tuesday that within two weeks the company might be able to honour warranties again. The 850 of you that bought the little printer will be happy to know that if Amber's parent group — W Lethaby and Company — is bought lock, stock and printer by another company you could retain your warranty.

Mr Rayner promised that if W Lethaby is taken over and he is still managing director of Amber, he will make sure that all warranties are honoured.

Michael Dawe, a spokesman for the receiver, said that if Amber is sold off he is certain no new company would honour Amber's warranty. And Mr Rayner admitted that in this case there would be nothing he can do to mantain the warranty.

No warranty work will be performed for free until these corporate machinations are sorted out. But if you want to pay for any service work done on your Amber, contact the receivers — J R Hawksley and A J Barrett — at Amber's address in Andover Hampshire.

Software hit by sneaky BBC update

A new-look BBC Basic that has slipped quietly onto the scene with the very newest BBC micros could leave some of your software high and dry.

The new version of Acorn's Basic — version 1.2 — includes changes to the TRIG and LOG functions, and there is a new command — OPEN UP — that allows you to update disk files.

But the changes also mean that certain programs written in a mixture of Basic and machine code are likely to crash when a program makes a direct call into the micro's Basic ROM to get at a particular routine.

With the new Basic, that routine may no longer be in the same place, so the call will not succeed.

Program Power is one BBC software house that has been hit by the changes. A company spokeswoman told PCN that the company has had to rewrite its Croaker game after complaints from Basic 1.2 users that it wouldn't run.

'As BBC dealers, we have had no word from Acorn that the Basic has changed', said the spokeswoman.

Charles Moir of Computer Concepts another BBC software house told PCN that it is mainly games problems that may not run under Basic 1.2. 'If a program is written properly, the changes should be transparent and make no difference', said Mr Moir.

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It's Week Three of the PCN Threebies Offer. Just like you, we're all rubbing our hands with glee. Because you now have the coupons from the first three issues.

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VIEW FROM AMERICA

Portables carry on and on and on . . .

By Chris Rowley

Osborne, the original portable computer company, had a reputed $100 million in sales last year. Thereby hangs a tale.

This year, manufacturers are hurling themselves into the portable microcomputer market like salmon attacking a waterfall. It seems that there is a widespread belief that just by making the machines extremely light and tricked out with enough bytes, drives and options, they'll be snapped up by the 'executive' market at almost any price.

Whether or not this belief proves well-founded, some of these fancy new machines are dazzling to the senses. Indeed, they are usually named after Greek deities.

Take for instance the recently announced Athena I, a 15lb battery-powered unit that uses a pair of National Semiconductor NSC800 chips and packs a standard keyboard, 5¼in floppy disks, 128K of RAM, and a pseudo disk of solid state RAM with 1Mb capacity, plus a 4 x 80 liquid crystal display — all inside a box 3⅜in by 11⅞in by 14½ ins.

Athena describes it as a 'high-end machine for the discriminating portable user'. The price tag is equally discriminating at $3,950.

Or how about the Hyperion (named after the Titan who fathered Aurora, Selene and Helios)? Hyperion is a titan that weighs just 18lbs. A 16-bitter, it uses the Intel 8088 chip and boasts 256K of RAM, a 320K floppy disk drive, a built-in modem, a 5in screen and some software for just $3,395.

There are literally dozens more of these machines, most of them from $3,500 and up. But the 'executive' sector is only part of the portable proliferation.

At the low end there is the 'lap' or 'notebook' computer, best exemplified by the Epson HX20. It is the size of a telephone book and weighs a lot less; it sells in the US for $695.

Now NEC is thinking of moving its comparable machine, the NEC PC8201, into the US and European markets following its success in Japan. This machine is even smaller and lighter than the Epson and has an 8 line by 40 column display, 16K RAM expandable to a full 64K, and a price that will be competitive with the Epson.

Of course executives who can afford $4,000 portable computers are generally the executives who never have to use one. They leave computing to their assistants while they fly Club Class and contemplate boardroom strategies.

So if it is the assistants, down the back of the Jumbo, who are going to be computing their way to LA, what are the odds they're going to compute with a moderately priced machine rather than some micro Lamborghini?

That question brings us to the meat and potato end of the portable market, the true transportables like the Osborne 1.

Osborne's big initial success came from its low price and the huge software giveaway that virtually paid for the hardware. In the past year Osborne's sales have ballooned. But the
argely in the form of the Kaypro II
California. Kaypro claims to be
sborne is doing even better.
will appear in April. First there is
elcom Industries, with twin 400K
nitor for just $1,595. Then there is
launching a range of portable
0 range. Later in the year Apple,
ompanies plan to enter the fray.
he late-comers. Not only will they
e's Law — low prices and free
: to face new machines like the
ne has up its sleeve for 1983.

Beeb airs 'free' BBC software

From the start of May some software is going to be as free as air for BBC users — and it will come to you through the atmosphere.

The BBC is about to start what it calls 'the world's first telesoftware service'. It will use Ceefax to broadcast software that can be loaded into your BBC Micro from the airwaves with the help of a teletext adaptor.

The BBC plans to broadcast 150K worth of software which it will recycle every 14 days. About two-thirds will be educational and one-third 'general interest'. The proportions will probably vary as the service develops.

There is a hidden cost. If you don't happen to own a teletext adaptor it will cost you £225 to buy one. Of course that will allow you to tune into both Ceefax and the software.

But don't expect sophisticated business packages or games immediately. The BBC views the telesoftware as a part of its TV programming, its purpose being to inform and educate. Besides, £225 would buy a substantial amount of commercial software; that isn't the BBC's market.

The educational software will be drawn from such sources as the BBC's microelectronics series and from Brighton Polytechnic, where an early telesoftware experiment involving the BBC, the IBA, and Mullard took place.

The general interest section will cover 'things that the ordinary user would like to do but may never have had the facilities'. In that category Ceefax's telesoftware expert, Lawson Brown, includes procedures and utilities such as sorting, file handling and screen dumping to a printer.

In the future the BBC expects to commission software particularly for its educational output.

An Acorn spokesman said that the teletext adaptors were available in quantity through its usual dealer and direct sales outlets.

Upgrades downplayed for Vic-20s

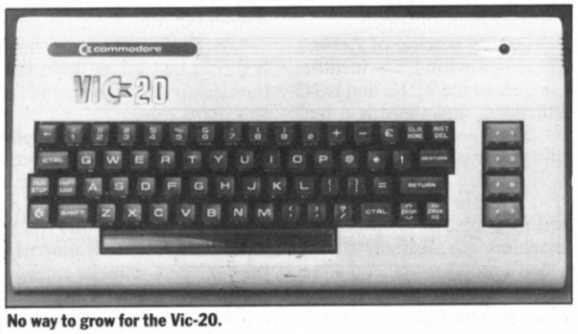
Vic-20 owners who have cherished an ambition to upgrade their machines to the 64 specification at only a small charge are in for a disappointment.

Last summer a statement from Commodore referred to the upgrade but now the company has decided not to offer it.

Ironically, it is the success of the Commodore 64 that is partly to blame. 'The conversion package hasn't proved necessary,' said a Commodore spokesman. 'Sales of both machines are so strong.'

He added that the systems, and especially the software being developed for them, were going in different directions — the Vic-20 to those learning about micros and the 64 to small business users.

Mike Ryan, chairman of the south-east branch of the independent Commodore user group, expressed regret. 'We would be disappointed if the idea had been scotched,' he said, 'but that doesn't mean that the opportunity isn't there.'



No way to grow for the Vic-20.

Newbrain sets CP/M date...

Grundy Business Systems, the maker of the Newbrain, has put yet another date on its CP/M launch. But just in case it doesn't make it, the company has lots of cassette software coming out too.

After a delay of months, CP/M for the Newbrain should be introduced on May 6. At the same time, the company will release a flood of games and business software.

Grundy is developing some 50 packages itself and has also commissioned packages from companies such as Kuma.

The cassette software that Grundy is writing includes French and German vocabulary exercises for £4.95 each and a word processing program for £30.

That extends the range beyond Tiny Word, also available for use on the Newbrain at £24.50, Brainwave's £25 package and Elstree's £40.25 pack.

Other programs from independents will apparently include List Manager (an index), Spreadsheet Calculator, Word Processor and Nominal Ledger System, Inventory Management System, Purchase Ledger System and Sales Ledger System, although Grundy will not release details.

Games include Chess at £14.95, Backgammon at £9.95, Blackjack, Othello, Space Battles (£9.95) and Quest, an adventure game.

All Newbrain software, as well as CP/M, will be available from Newbrain outlets in May.

...Lynx now to offer upgrade

Camputers is now claiming that CP/M will be available for the Lynx at the end of April.

The company promises that its 96K RAM upgrade plus single- and twin-disk drives will be ready by that date.

Paul Bailey, director of European Operations at Digital Research, said: 'We are talking to them and as soon as the upgrade is launched we will license them as a matter of course.'

All this will make Lynx one of the lowest-cost business machines on the market. A 96K version plus two 5¼in disk drives will cost about £700, while CP/M will allow you to run business software that is already on the market.

A spokesman for Lynx said: 'The machine is aimed at home users and small businesses and will hopefully bridge the gap between the two markets.'

The system plus disk drives will be supplied by Spectrum Centres and selected branches of Lasky's. Prices will be £300 for the upgrade, about £250 for the single disk drive and just under £400 for the twin disk drive, all inclusive of VAT.

Camputers will have its first home-written game out at the end of April and more games are expected from Romik, the software house.

Intellivision keyboards at a premium

Mattel is planning to release a keyboard for its Intellivision games machine, but it will cost you nearly as much as the company's new micro, the Aquarius.

The keyboard that will turn Intellivision units into micros is expected in September but it will set you back about £100 — only £30 less than the Aquarius.

This price may not make it appealing to those of you with the games machine, which set you back £130 in the first place.

As Mattel admits, the only advantage of the keyboard is that it gives you a micro that will use Intellivision game cartridges. The Aquarius will also have cartridges but its software won't run on the Intellivision unit or vice versa.

The latest promise of a keyboard for the games machine continues a two-year tradition of uncertainty that Mattel began in North America when it first started selling the machine. At that time the literature accompanying the Intellivision bore a picture of a mock-up keyboard.

PCN Charts

PCN Charts follow the rise and fall of the UK's best-selling micros. This fortnightly top-of-the-shops list tells you what's selling best over the counter; it does not take account of mail order and does not count deposit-only orders. This week's figures show the number of machines sold in the two-week period ending a week before publication date (in this case March 25), so these charts tell the story in high streets between March 4 and March 18.

Machine prices quoted are for the no-frills models and include VAT. Information for the PCN Charts is culled from retailers and dealers throughout the country and compiled by MRIB, London. They will be updated every alternate week . . . so watch for the arrows to follow the ups and downs of the best-sellers.

Top Twenty up to £1,000

	MODEL	PRICE	DISTRIBUTOR
→ 1	BBC Model B	£399	(AC)
→ 2	Sinclair ZX81	£50	(SI)
↑ 3	Sinclair Spectrum	£125	(SI)
↑ 4	Atari 400	£160	(AT)
↓ 5	Newbrain A	£299	(GR)
↓ 6	Commodore Vic-20	£170	(CO)
↑ 7	Dragon 32	£200	(DR)
↑ 8	Jupiter Ace	£90	(MM)
↑ 9	Oric 1	£100	(OR)
↓ 10	Atari 800	£400	(AT)
↓ 11	Commodore 64	£345	(CO)
↓ 12	Acorn Atom	£174	(AC)
↓ 13	Apple II	£776	(AP)
14	Sharp PC1500	£170	(SH)
↓ 15	Texas TI99	£150	(TE)
↑ 16	Epson HX20	£472	(EP)
17	Lynx 48	£225	(CA)
↓ 18	Colour Genie	£224	(LO)
↓ 19	Tandy TRS Colour Computer	£240	(TA)
→20	Commodore 4016	£632	(CO)

Top Ten over £1,000

→ 1	Sirius 1	£2,754	(ACT)
↑ 2	Osborne 1	£1,581	(OS)
↓ 3	Olivetti M20	£2,754	(OL)
↑ 4	HP 86A	£1,541	(HP)
↓ 5	Apple III	£2,780	(AP)
6	Commodore 8032	£1,029	(CO)
↑ 7	Sanyo MBC 1000	£1,195	(SA)
↑ 8	Micro-Mimi 803	£1,720	(BM)
9	Sharp PC3201	£2,300	(SH)
↓ 10	Xerox 820	£2,415	(RX)

AC — Acorn Computers. **ACT** — ACT Sirius. **AP** — Apple Computers. **AT** — Atari International. **BM** — British Micro. **CA** — Camputers. **CO** — Commodore. **DR** — Dragon Data. **EP** — Epson. **GR** — Grundy Business. **HP** — Hewlett-Packard. **IC** — Icarus Computers. **LO** — Lowe Electronics. **MM** — Micro Marketing. **OL** — Olivetti. **OR** — Oric. **OS** — Osborne Computers Corporation. **RX** — Rank Xerox. **SA** — Sanyo Marubeni. **SH** — Sharp. **SI** — Sinclair. **TA** — Tandy. **TE** — Texas Instruments.

Playing the Ace

If you can't wait for Jupiter Cantab to produce RAM packs or software for its Ace don't panic. Other suppliers are stepping in to fill the breech.

Micro Marketing (01-736 1683) is selling the Pacer, a 16K RAM pack, for £29.95 which can ben extended to 32K for an additional £19.95.

The company is also selling games for the Ace that start at £4.50.

Brighton-based Remsoft (0273-602354) has also launched a range of software. Prices vary but you can get three games — Appleater, Parachute and Meteor Cruise — on one tape for £5.50.

It also offers various utilities such as a Toolkit and a Screenkit for £7.50 each.

The Pacer 16K RAM pack will plug the Jupiter Ace extension gap.

Jupiter itself is still quoting several weeks' delay in its RAM pack deliveries.

But even when it comes it looks as though it will be pricey in comparison to competitors. The Jupiter Ace 16K RAM pack will cost £35 and the 48K version will be sold at £80.

Jupiter Cantab says its first batch of software is currently being copied for release in the next two weeks. It will be selling two 3K games on one tape for £5.95 and 19K games will cost £7.95.

Bytes for the dentist

You will soon be able to get your teeth into a new North Star Horizon look-alike micro designed for use by dentists.

The Dentron, due for release in about six weeks, will offer CP/M or North Star DOS, 64K RAM and two floppy disk drives — for less than £1,800.

Philip Kurland, a Harley Street dentist involved in writing North Star dental software since 1978, is a director of Trader Computers, the company producing the machine.

'Depending on the configuration, our machine will sell for about £200 less than the Horizon', Mr Kurland said.

The machine will support between ten and 12 expansion boards using an S100 bus and offer either the dual disk drives or a 2Mb hard disk and a floppy.

More joy and less stick

As every Vic-owning games player knows, you can get better controllers than the 'official' joystick, and the Quick-Shot joystick from Spectravision promises to have a ready appeal to addicts.

Anyone with an Atari, Vic-20 or NEC machine can use the stick, which costs £11.95.

It is solidly built and consists of a helicopter-style grip and two firing buttons, one of them on the top of the stick. You can fix it to any smooth, flat surface using four suction cups that can be fitted to the unit.

The free movement of the grip is claimed to give the illusion of 360-degree control and it is described as very responsive. And as it comes with a 4ft lead you won't have to sit on top of the television to use it.

The Quick-Shot is distributed by Vulcan Electronics in Hendon, London NW4. The company can be contacted on 01-203 5161.

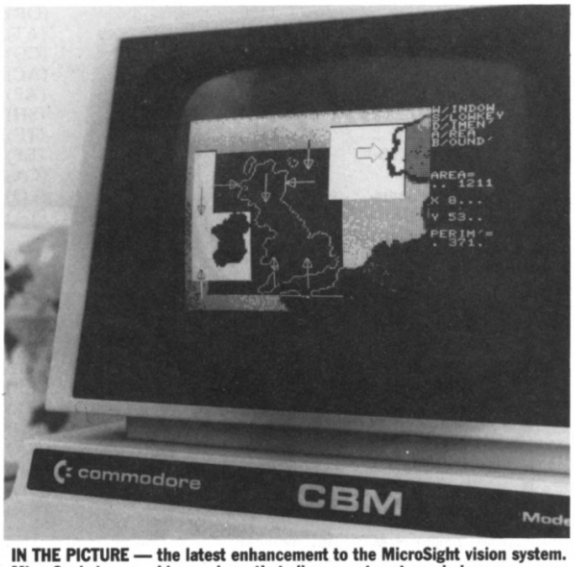
Cold comfort on the Apple

If you've ever tried clearing the screen and homing the cursor in CP/M on an Apple IIe with an 80-column card slotted in, you'll have found a bug. It doesn't happen.

This irritating feature has now been overcome by Murray Arnow, consultant to the Apple PugetSound Program Library Exchange (A.P.P.L.E.). Arnow has written a patch that solves the problem for systems running CP/M versions 2.20B and 2.23.

According to Arnow the problem stems from a habit of Microsoft's CP/M Bios. It initialises the peripheral cards in all the slots on a warm boot.

The remedy is to take the initialisation routine from the warm boot and to make the Control/Reset perform a cold boot. This cold boot initialises the peripheral cards.



IN THE PICTURE — the latest enhancement to the MicroSight vision system. MicroScale is a graphics package that allows you to set up windows on-screen and determine the dimensions of the features within the captured image. MicroScale costs £295 plus VAT from Digithurst on Cambridge (0223) 208926. It will run on most machines supporting high-resolution graphics.

UK launch for Texas micros

Two new home computers and a clutch of peripherals from Texas Instruments made their first appearance in the UK last week at the World Trade Centre, London.

The TI CC-40 micro and three peripheral devices will be on sale in the next few weeks. But you'll have to wait until September for the TI 99/2.

Both the CC-40 and the 99/2 are aimed at home users. The CC-40 costs £169.95 and is a portable to compete with the Epson HX-20. It includes an LCD display, the enhanced Basic of the 99/4A and comes with 6K of RAM, expandable to 16K.

The 99/2 — also operating on the 99/4A's advanced Basic — has a soft keyboard and drives a black and white display. The memory ranges from 4.2K to 36.2K.

This system sells in the US for less than $100. Its UK price has yet to be fixed, but a Texas Instruments spokesman said that whatever happens between now and September it will not be more than £75.

The peripherals on view at the World Trade Centre included an RS232 interface, a small printer/plotter, and a Wafertape digital tape drive. The Wafertape, which has a capacity of 48K and a data transfer rate of kilobits per second, will cost £119.95.

Texas Instruments is on Bedford (0234) 67466.

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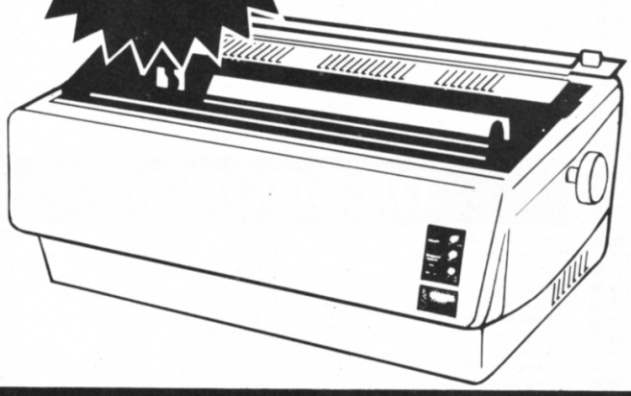

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Acorn Atom 747	FP	Bug Byte	02A002	£8.00
Atom Breakout	4K	Buy Byte	02A003	£16.00
Fruit Machine	8K	Bug Byte	02A004	£4.00
Pinball	16K	Bug Byte	02A004	£4.50
Atom Invaders	12K	Bug Byte	02A005	£8.00
Galaxian	12K	Bug Byte	02A006	£8.00
Atom Man	12K	Bug Byte	02A007	£8.00
Labyrinth	12K	Bug Byte	02A008	£7.00

B.B.C. MICRO

Space Pirates	16K	Bug Byte	02B001	£8.00
Space Warp	32K	Buy Byte	02B002	£9.00
Golf	32K	Bug Byte	02B003	£5.50
Dragon Quest 1	16K	Bug Byte	02B004	£11.50
Fruit Machine	B	Bug Byte	03B006	£5.50
B.B.C. Airlift	B	Bug Byte	02B007	£5.50
Polaris	32K	Bug Byte	02B008	£5.50
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Swoop B/A	32K	Micropower	24B029	£6.95
Alien Destroyers	32K	Micropower	24B030	£6.95
Galactic Commander	32K	Micropower	24B031	£6.95
Timetrek	32K	Micropower	24B032	£6.95

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Astro Navigator B/A	32K	Micropower	24B034	£4.95
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Footer B/A	32K	Micropower	24B036	£6.95
Adventure		Micropower	24B037	£6.95
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Filer		Micropower	24B044	£8.95
Micro Budget		Micropower	24B045	£6.95
Constellation B/A	32K	Micropower	24B046	£5.95
Disassembler		Micropower	24B047	£5.95
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A modem plus a micro plugs you into telex

With just a micro and a modem you'll be able to hook yourself into one of the UK's most versatile communications systems from next month.

Telecom Gold, a service set up by British Telecom and Dialcom, will be launching a Telex service on the national packet-switching network. But besides the ability to send and receive telexes, Telecom Gold also offers some new software utilities, plus a means of sending telegrams, and radio paging.

If you run a small business this could be a way of getting a telex connection on the cheap. Subscribers to Telecom Gold pay only for the time and storage space on the Telecom Gold computer. The typical monthly charge at the moment is £12.

A conventional telex terminal can cost as much as £2,000 a year to rent. Any micro that can support a modem will now be able to do the same job.

In addition, the Telecom Gold extras include software to help design forms and to check the spelling of text sent on to the network.

Existing services cover electronic mail, shared data files, and an electronic noticeboard.

To use Telecom Gold you transmit data and messages to its central computer via the telephone network. Telex messages intended for you will be held by the system until you make the telephone connection.

A sample group of users has been testing the new services.

Speed boost for Apple II

Pete and Pam Computers has launched the micro industry's equivalent to a turbo charger for your Apple II Plus.

The plug-in Accelerator II board pushes the speed of the Apple II Plus from 1MHz to 3.58MHz, Pete and Pam claims.

The Accelerator II comes from a US manufacturer, Saturn Systems. Its board holds a 6502C processor and 64K memory. You can run any native Apple II software through it.

The board is available immediately, price £299, from Pete and Pam on Rossendale 0706-227011.

All aboard for the Ethernet station as costs begin to fall

The cost of putting your micro onto an Ethernet networking system is coming down. But it may pay you to wait another six to 12 months, when it will be even cheaper.

Reading-based Sintrom has come out with a two-board Ethernet controller that plugs into the S100 bus. It costs £863 and requires only the addition of an Ethernet transceiver to turn your micro in a fully-fledged Ethernet station.

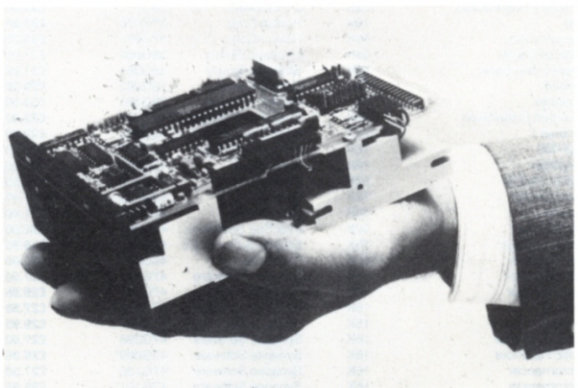
By summer you should be able to hook an IBM PC up to Ethernet with a plug-in board from US firm Tecmar. It will be distributed in this country by Comart, which expects the price to be around £750.

Chip manufacturer Intel has now completed testing of two special chips that should bring down the cost of Ethernet controllers to around £250.

But as the company has pointed out, it is unlikely that this price will be reached until well into next year.

Later in the year Apple hopes to launch its AppleNet system for the Lisa, Apple II and Apple III.

This is Ethernet-compatible and will cost around £400.



DRESSING DOWN — Micro-floppies will be coming out of their shells this summer. US manufacturer Tabor is dressing its 3¼in disks in flexible jackets rather than the plastic shells that others are using for disks of this size. Its Drivette 500 has a capacity of 500K and is said to be compatible with 5¼in drives, although it is lighter, smaller, and uses 40 per cent less power. Tabor is looking for a UK distributor, and can be reached on 0934-514916.

Management with a Torch

If you want to throw some multi-coloured light on the state of your company's finances you will be interested in the new management accounts package for the Torch.

Called Torch-Mars, it is the Sapphire management reporting and information package adapted to take advantage of the Torch's colour graphics and electronic mail facilities.

It costs £460 and is obtained only through Torch dealers.

Like other spreadsheet programs, Torch-Mars uses menus to take the user through the system to handle financial modelling, planning, budgeting and predictions.

Torch can be reached on 0223-841000.

A bit of a holiday break

Young micro fanatics keen to take a busman's holiday have more places to choose from this year.

Beaumont Summer Camps, which runs micro training courses in rural tranquility, has increased the number of its centres to nine. This Easter and summer you can train on micros between canoeing, judo, sailing and archery at a choice of sites from Devon to the Lake District.

The full residential camps, in the Lake District, Dorset and Devon, are for children aged from nine to 17. Non-residential camps at Windsor, Sevenoaks, Godalming, Mill Hill and Brentwood are for the four to 15-year-olds. There is also a day camp at Knutsford.

Computing takes up half of each day at the camps. Beaumont aims to cater for children at various stages of computer literacy. It gives each individual a micro to use — most of them are Vic-20s — and at some camps this year it will be including tuition on elementary robotics and microelectronics.

You'll pay from £68 plus VAT for a five-day non-residential course to £118 plus VAT for a seven-day residential camp. Next one is in Dorset over Easter.

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Simon's not so simple

As the Commodore 64 microcomputer has recently received a number of bad (and uninformed) reviews, I thought I would set the record straight. Reviewers seem to be becoming as keen as manufacturers to get their products on the market, ready or not.

Firstly if Commodore wishes to make Simon's Basic an option then those who don't want the most sophisticated Basic available on any micro don't have to pay for it. Commodore made no secret of this.

The Commodore 64 also has the most powerful sound chip available on any micro. SID has three voices (three notes polyphonic) and each voice is separately synthesised and controlled. Each voice can have three possible waveforms or be random noise.

The envelope shape of each can be controlled in the same way as the Casio VL-Tone (ADSR). Each note can then be filtered with programmable filters. These can be changed dynamically while the music is playing to produce phasing and *waawaa* effects, etc. Synchronisation, *eg*, tremelo, and ring modulation (as used by Hendrix) are also available. The sound quality is superb.

There are three graphics modes (excluding sprite graphics and character graphics, which can take any of these modes and can be mixed with them): —

1. 340 x 200 with two colours out of 16 in each character square (as in the Sinclair Spectrum). This 16-colour high-resolution mode fits into only 9K RAM (compare 20K with eight colours and a lower resolution on the BBC) and thus more than one page of graphics may be stored, enabling animation.
2. 160 x 200 with four colours out of 16 in each character square. One colour depends on the character square and three colours are global, so if the appropriate colour register is changed the whole part of the screen set to this colour changes instantaneously. We still have 16 colours in 9K. Further, modes (1) and (2) may be mixed so that any part of the screen (any character square) may be in either mode.
3. 160 x 200 with four colours in each character square, three colours depend on the character square and one is global (still 9K). The 16 colours available can be increased to more than 50 in any mode by colour mixing, or up to 136 including textures.

My only niggle is that the colour resolution is not too good with some foreground-background combinations (detailed in the manual). However, there is no dot crawl, no flicker, no rolling bands of colour and no spectral distortion.

The sprites are amazing (much better than Atari's). Each one can be in a different colour mode. Not only that but each one is not just an area in memory but a pointer to an area in memory. You can move the

pointer using just one POKE, so that the sprites don't just move around but can be fully animated, in colour, by moving the pointer between different (64-byte) blocks of memory, each containing a frame from the animation — and all in Basic.

Sprites and characters and the screen border have full collision detection and priorities. So no wonder Simon's Basic adds more than 100 commands to Basic. It would need to.

So you get a 64K 6502 machine for around £300 (inc VAT). Simon's Basic is £50. The Vic digital cassette deck is very reliable at about £40, or you can buy a kit to convert an ordinary mono player for only £7 (Swanley Electronics). RS232 serial and IEEE488 parallel interfaces are standard though (as is common) they require a voltage level converter, as the Commodore runs on 5V logic.

A ROM insertion board is available for about £20 which doubles the memory capacity of the 64 and allows use of monitor and assembler ROMS. Light pen and joysticks are about £20 each.

Commodore Basic is about the fastest of the common home computers, except for the BBC which is about twice as fast. Commodore cartridge games will be about half the price of Atari's. A Z80 cartridge will be available shortly.

So if Commodore could improve its colour resolution there would be no competition for this new machine. The keyboard is certainly the best available on any home computer, and compares favourably to the ones on the new Tektronix 4112 terminals. The four function keys (just as stupid an idea as the ones on the BBC micro, they are just the same as any other key) could better have been replaced by a numeric keypad.

My recommendations to new buyers then. If you have £100 buy an Oric. The graphics are a bit weird, but it's a much better machine than Sinclair's. If you have £225 by a Lynx. I haven't seen one yet, but with 48K RAM, a good keyboard and apparently excellent graphics you can put up with its many idiosyncrasies (particularly a slow screen display).

Note that there is only 16K user RAM. The first update costs £75, so if you can afford around £350 buy a Commodore 64 and Simon's Basic — it's worth it.

What's wrong with the BBC? In high resolution graphics with eight colours there is only about 10K left for your program, even on the model B. Commodore Basic leaves 38K (this involves paging (easy) giving a total ROM/RAM of 80K).

Simon's Basic leaves you 31K with 16 colours and the same resolution, with 16K for the Basic ROM, 9K for the screen, 4K for the system and 4K for machine code programs. (Though of course you can reorganise memory at will.)

Finally, if anyone is interested in an independent Commodore 64 user club will they write to me at 47 Park Avenue, Barking, Essex, enclosing a large SAE and a postal order for fifty pence. I would be interested at the same time to hear of any inquiries or comments users may have.

Keith Bowden,
Senior lecturer
North East London Polytechnic

I spy a Vic pic

I am writing to tell you of an error I noticed in the first issue of your magazine concerning the article 'Commodore declares a price war'.

The story refers to Commodore International declaring a price war in the USA over the Commodore 64, but the photograph accompanying the article is of the Commodore Vic-20, not the Commodore 64.

Although they are of a minor nature, there are two differences:

1. Control port — two on the 64, one on the 20.
2. Power light — '64' on the 64, 'power' on 20.

R Barnes
Gillingham, Kent

Well spotted, PCN blushes all round — Ed.

The Commodore 64 dollar question

It is understood that software on cassette will always be in short supply when a new computer is introduced, but I fail to understand why we Commodore 64 owners cannot even obtain instruction books on how to make the machine work.

I have tried everywhere to get a stage further on from Introduction to Basic Part One. Where is part two? It must be available in the US and we all speak the same language.

So come on, Commodore. Life is short and we cannot wait forever.

G S Dutton,
Harwich, Essex.

Root out the rivalry

I am fed up with the rivalry among us computer users, especially between the BBC and Spectrum users. They seem to spend most of their time condemning each other's machines.

I have had experience on both these machines and think they are both great machines.

There should be less of this rivalry between us. After all, we have all been bitten by the computer 'bug' and lots more people will be in the future.

Also regarding Ray Thomas's letter 'Capital offence' (in your launch issue) about capital letters being used for Basic key

words. If he wants to distinguish between his key words and variables, the easy way out is to use lower case letters for his variables. These can be detected with little difficulty.

Congratulations on a very fine first issue, especially on 'The Anatomy of the BBC Micro'.

P Grumann
Colchester, Essex

The flipside of the BBC

In your March 18 issue, there are some comments about the BBC User Guide (page VII of PCN Micropaedia).

Out of curiosity I tried a *TVO, 1 and went to mode 3. The whole screen began to 'flip' at a regular half-second frequency. So much for your claim of a stable picture!

However, this gives a clue to the reason why Acornsoft Planetoids does the same thing on our set-up, which is a Model B with a Philips 14in colour portable (14CT3005050S).

Is it just that this TV does not like having interlace turned off?

Incidentally, *FXO is explained on page 421, and *HELP does not work on my machine, which claims to have 'OS EPROM 0.10' when *FXO is used.

Here's wishing less finger trouble with future issues!

C G Peacock
Croydon, Surrey

*As we said in Micropaedia, the interlaced signal is for use with PAL monitors (TVs), so turning it off can make the TV picture worse. The *TVO, 1 is chiefly used to fix pictures on RGB and Composite video signals.*

*As for the problems with *FXO and *HELP, it should be noted that *HELP will not work on some earlier operating systems — Ed.*

A premium-priced printer, please

So Ken Forster's 'proud to be British' (March launch issue) 'cos we have 'the talent and the drive to make a mark on the world'.

Not in the world of applied micro-processing we don't, Ken. This reader's spent the last year looking for a sensible small-scale word-processing package — say, keyboard, screen, memory and letter-quality printer, or, if you like, the nearest thing to a video typewriter.

This outfit would match to perfection my needs (and maybe those of another 30,000 UK journalists) who write, say, two newspaper and magazine features a day, each of around 1,000 words.

So, all I want is micro-processing advantage in A4 and manual format (tho' it'd be nice someday to add telephone coupling and book-length memory.)

But what do I get? How's about this for pathetic market research, for a start:

1 A computer-exhibition 'expert' in Edinburgh tells me a daisywheel printer that goes 'only' 120 CPS is too slow. Tell that to the next professional writer you meet.

2 Osborne's briefcase machine goes (or was going) for £1,250 — but half of that's for big-office gobbledegook that I don't want, won't ever need, and am damned on principle if I'll buy just to get my hands on the rest of it.

3 *Personal Computer News* advertises (back cover, launch issue) a Commodore 64 word-processing package for £86. Great — that sounds like the kind of thing that would suit my needs. So I buy a Commodore to go with it — and to get a daisywheel printer appropriate to my modest needs, I have to buy *another* keyboard as part of a daisywheel typewriter/printer unit.

I could go on, but it's not necessary. The point is unchallengeable — British makers don't even seem to have noticed a gap in a professional, albeit small-scale unit, market.

I'll be the first to buy the unit that will connect a cheap daisywheel printer/typewriter to my telly and give me the word processing capacity I want — unless one of Ken Forster's Great British Entrepreneurs can come up with a better configuration.

But until then, I'll stay on being proud to be Scottish, and hammering away at this old Olivetti. It might suit the 19th century better — but at least it gives me what I want and what I need, and all at a reasonable price too.

Iain Fraser Grigor,
Glasgow, G12

We'll put Max 'Fixit' Phillips onto this and see what he comes up with — Ed.

PCN Paperchase

This is it. You've had two parts . . . now it's crunch point. Or, more accurately, now the race really is on. If you've unravelled the first 15 lines of PCN Paperchase you're already two-thirds of the way to winning one of four BBC Model Bs.

You'll no doubt remember that all you have to do is sort out a 30-line program written in BBC Basic that got jumbled before it was numbered. In the first part the program puzzle consisted of five lines which, when run correctly, gave a unique number. The second part involved putting 10 lines in the correct order to produce a three-word phrase.

Now, here's the final 15 lines. Sort them out, find the proverb and fill in the missing word. You will need to use the answers to the first two parts to do this. Then complete the coupon below and send it to Paperchase, Personal Computer News, VNU, 62 Oxford Street, London W1A 2HG.

Don't delay — closing date is April 8. All correct entries will go into PCN's competition hat and the first four pulled out will each win a BBC worth £399.

You don't have to use a computer to solve Paperchase. Common sense and logic will do the job. The program is written in BBC Basic, so with only minor adjustments (such as a comma instead of a semi-colon) it will run on any machine using Basic.

This competition is not open to employees of VNU Business Publications.

```
LIST
  A$ = A$ + MID$(P$,13,1): A$ = A$ + MID$(P$,4,1)
  A$ = A$ + MID$(P$,7,1): A$ = A$ + MID$(P$,11,1)
  FOR C = 1 TO CC%: PR$ = MID$(A$,C,1) + PR$: NEXT C
  A$ = A$ + MID$(P$,3,1): A$ = A$ + MID$(P$,6,2)
  A$ = A$ + MID$(P$,4,1): A$ = A$ + MID$(P$,16,1)
  A$ = A$ + MID$(P$,14,1): A$ = A$ + MID$(P$,1,1)
  PRINT "PROVERB = "; PR$: END
  A$ = A$ + MID$(P$,16,1): A$ = A$ + MID$(P$,9,1)
  A$ = A$ + MID$(P$,2,1): A$ = A$ + MID$(P$,4,1)
  A$ = A$ + MID$(P$,14,1): A$ = A$ + MID$(P$,6,1)
  PR$ = "": A$ = MID$(P$,5,3) + MID$(P$,11,1)
  A$ = A$ + MID$(P$,1,2): A$ = A$ + MID$(P$,16,1)
  A$ = A$ + MID$(P$,17,1): A$ = A$ + MID$(P$,8,1)
  A$ = A$ + MID$(P$,4,1): A$ = A$ + MID$(P$,17,1)
  A$ = A$ + MID$(P$,12,1): A$ = A$ + MID$(P$,4,1)
```

The proverb is_____

_____

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Telephone number_____

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ROUTINE INQUIRIES

Max 'BDOS ERROR ON A' Phillips opens the pod door, Hal. Got a query? Send it here. No personal replies promised but you never know . . .

Got a light, Max?

I want to use my Commodore 64 machine to turn the lights on and off as a home security device, but I don't know of any suitable programs. First, is it possible to do this, and second, do you know where I can get hold of the software?
B Green,
Christchurch, Dorset

You can do this, but it needs some care in wiring up the 64 because you can't just wire it to the light switch. If you don't know how to wire it up, you'd be better off looking for a ready-made piece of hardware to do the job. This will come with any relevant software.

If you do manage to wire up the 64, and you can program a little, then you shouldn't find it difficult to write the software you need. Turning the lights on and off will be done with simple POKE statements.

Talk Turtle to me

Much has been said lately about Logo and the famous Turtle. Forgetting for a moment the implementation of the language, where can one obtain a turtle and how much is it likely to cost?
S Ericsson Zenith
Hayle, Cornwall

Turtles, like mice, are complex mechanical beasts. So don't expect them to be cheap. Jessop Microelectronics (01-739 3232) sells the 'Edinburgh Turtle' for £350 excluding VAT. It's currently available for Apple II, BBC B and RML 380Z and comes with OKLogo, a subset of the original language.

An alternative is the BBC Buggy, which is produced, from Fisher-Technic building bricks, by Economatics on 0742 690801. The first version will be available in May for the BBC micro for around £180.

Besides cost, the Buggy scores on being a flexible little robot that can do more than your average turtle. Economatics expects to attach the Buggy's leash to other popular school machines this year.

If you can't afford the hardware, it is possible, if not as much fun, to simulate a turtle on any high-resolution graphics screen.

Roots of the rodent

Can you tell me where the word mouse came from in its computer sense?
H Miles
Middleton, Leeds

What has two button-like ears, whiskers and a long tail? Well, that's where they say it came from. Apple's use of only one button is likely to have little effect on the original's genetic pool.

Making a computer from a kit

I've always liked taking things apart and rebuilding them (sometimes) and now my interest is in microcomputers, I'd like to make my own rather than buy the ready-made machine.

Can you suggest some suitable kits for around £300?
Martin Atkin,
Preston, Lancashire

Building micros isn't like building most things, so it might be wise to try something simple before you buy £300 worth of components. You'll get more satisfaction out of building a micro that can be easily used, so go for a kit that gives you a full keyboard, a TV display and a language such as Basic.

For starters, the Acorn Atom is now a classic hobbyist machine. You can go on adding bits and pieces as you feel like it.

If you want something a little more difficult, try the Cortex from Powertran (tel: Andover 64455). A £340 kit gives you a 16-bit machine with 64K RAM, colour high-resolution graphics and Basic. If you get hooked you can add disk drives, more RAM and so on.

Finally, if you want something more business-like, Transam (01-405 5240) still sells the Truscan in kit form for £390.

Write to: Max Phillips, Routine Inquiries, Personal Computer News, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

Can he become a micro ace, by Jupiter?

I want to buy a Jupiter Ace for my son, but I am worried because it is a native Forth machine. I don't know much about this language — my own micro runs Basic — and wonder whether my 15-year-old will be able to get on with it. Could you advise?
T Jones
London E12

Forth is the least of your worries. It may be unusual and unfamiliar, but it can be used to produce compact and fast programs with little more trouble than Basic. It's not harder, it's just different.

It's the Ace you ought to think about. It's black-and-white only, and the price includes less than 1K RAM free for Forth to use. There's also very little packaged software available at the moment.

So the Ace is very much a hobbyist machine. You would do well to consider some of its competitors, with colour, more memory and so on. In this case, if your son tires of Basic, you could buy Forth on cassette.

Incidentally, watch out for the next week's Micropaedia — on Forth.

Is my TI safe from sizzling?

I read in an American magazine that the TI-99/4A's power transformer might give electric shocks. As a TI user should I return my transformer? It's the UK version, not the 110-volt transformer.
J McCulloch,
Coatbridge, Strathclyde

Texas says the UK version of the power supply is perfectly safe.

If you bought a Spectrum after this January and it has a white stripe on the power pack lead, you should send it back.

Daisy or dot for my Dragon?

I want to buy a printer for my Dragon, for use at home. Can you tell me the difference between daisywheel and matrix, and which would be best for me?
S Webber
Woking, Surrey

A dot matrix uses a grid of pins to form the characters it prints. This is a fast but often scruffy method of printing. It also allows dot matrix printers to do tricks like print customised characters or high resolution graphics.

Daisywheels use pre-formed characters on the petals of a daisy-shaped wheel. So you get a print of a much higher quality, but at a slower speed.

Which is best depends on what you want it for. A daisywheel is better for word-processing work, and a matrix for things like programming. But modern dot matrix printing can be fairly high quality, and tends to be cheaper.

Swapping software between Sinclairs

Is there any way I can use programmed cassettes for the ZX81 on a Spectrum?
Martin Whatmore,
Cinderford, Glos.

It's theoretically possible to read a ZX81 cassette on a Spectrum but there's little point in doing it.

Although the two machines have similar Basics, the way they store a program differs. Machine code programs will not work either, since the memory is arranged in a different way on the two machines.

Your best bet is to list the programs on a ZX81 and use both manuals to make a translation for the Spectrum. Then all you do is key them in.

Learning lessons from Logo

In the BBC television programme *Talking Turtle* only Logo was mentioned. Is this language particularly suitable for teaching, and has it caught in in this country?
V. Walker
Bromley, Kent

Logo is a powerful learning tool, and because of it America will soon be full of five-year-olds who are quite happy to use procedures and recursion without having heard the words.

At the moment the kids know more about Logo than the grown ups, but there are other languages specially designed for education. Pilot is being taken seriously now versions for the Apple and Atari make it suitable for schools. It is designed to allow teachers to write 'lessons' without having to learn a complex programming language.

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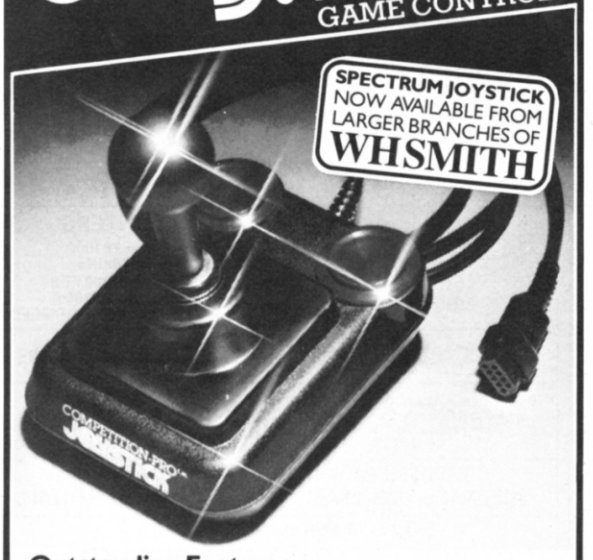

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Array of light on the Dragon

The Dragon 32 is an excellent computer and its fine graphics commands make it simple to use.

The GET/PUT commands are especially useful as they allow the definition of any size figures on the screen.

The manual suggests that a two dimensional array should be set up. This is, however, extremely wasteful of memory as can be shown by the following example:

DIM A (20,20) creates an array 400 bytes large. A much more economical method is to use a single dimension array.

To utilise this trick, the horizontal and vertical magnitudes should be calculated together with their product. Divide this product by 8 if in PMODE 3 or 4, by 16 if in PMODE 1 or 2, and by 32 if in PMODE 0.

So to calculate the new array size for the above array:–

20×20=400
PMODE 0 400/32=12.5 (round up)=13 DIM A (13)
PMODE 1 or 2 400/16=25 DIM A (25)
PMODE 3 or 4 400/8=50 DIM A (50)

This simple operation works only when the G specifier is used but does save much memory space.

Walter Anderson,
Woodend by Winchburg,
West Lothian.

Thanks for the memory

Owners of the TI 99/4A have one way of finding out if their program fills memory or not — an error message MEMORY FULL.

In TI Extended Basic there is a SIZE command to find out how much unused memory there is — but this is not available in TI Basic (Console Basic).

All is not lost — there is a rather rough and ready way out of this — use a small program which increments a counter and steadily uses up memory — then when you receive the MEMORY FULL message you only need look at the counter. An example:

```
100 T = T + 1
110 GOSUB 120
120 GOTO 100
```

Now enter RUN. When the error message appears, in the direct mode type PRINT T * 8.

The figure you see is (approximately) the amount of free memory. You will quickly note that you don't have 16K — the screen and operating system occupy some of the RAM.

Owners with Extended Basic using SIZE for a comparison figure will receive a slightly different answer, as SIZE looks not just at the program size, but also takes note of any stack space used (in this case, to store the value of the variable T).

Add this three-liner to the end of the program. If it starts at line 3000, enter RUN 3000, then after the error message, PRINT T*8.

Now you have some idea of how long your program is.

Stephen Shaw,
Stockport, Cheshire.

Saving your Spectrum's sockets

I have a tip for Tony Mason who wrote in complaining that the only way to reset his Spectrum is to pull the plug out.

There is another way. RANDOMIZE USR 0.

This will clear the memory, reset the pokes and RAM TOP. In other words, pulling the plug out and putting it back in again.

Bernard Stangroom,
Sutton, Surrey.

A new angle on the ZX printer

Here is a tip for owners of the ZX printer. As you have probably experienced, the printer frequently produces illegible copies, wasting the expensive thermal paper.

I have found that if you tilt the printer forwards by placing two large lumps of Blu-Tak under the back feet, or resting the back of the printer on a small book, it will produce good

copies almost 100 per cent of the time.

Also try to make sure the printer is regularly cleaned with a dry tissue, and that the roll of paper is quite tightly wound on.

J R Mortleman,
South Woodford,
London E18.

Cursed cursor fixed in a flash

Here are two tips to help owners of the BBC micro. If any of you have cursed the cursor for flashing when you have run a listing from a magazine that has taken ages to type in, I have the remedy.

List your program and put this line in somewhere:–

?&FE00=10:?&FE01=32

That should get rid of the cursor.

If you are creating a game where you want to move an object, the obvious keys to use are the cursor controls. But to be able to use the cursor keys you must first enter *FX4, 1. This causes the cursor and COPY keys to produce their ASCII codes instead of moving the cursor.

The codes are:–

COPY . . . 135
LEFT . . . 136
RIGHT . . . 137
DOWN . . . 138
UP . . . 139

These codes are used in INKEY or GET commands just like any other keys.

*FX4,0 will return the keys to their usual mode of operation.

Jonathan Plews,
Daventry, Northants.

Big SCREEN $ brought to BBC

I own a ZX Spectrum and recently borrowed a friend's BBC micro. At first I was very impressed until I realised BBC Basic does not contain a SCREEN$ function.

So after scouring the user's manual for two weeks I came up with an FN function to simulate SCREEN$:–

```
DEF FNSCREEN (X, Y)
=HIMEM+(Y*40+X)
*8+MODE
```

When you want to use the function it can be called by:–

```
A%=FNSCREEN (X%, Y%)
or
If FNSCREEN (X%, Y%)=CHR THEN . . .
```

In the first example the code for the character at the specified position will be stored in A%. X% and Y% are the coordinates to be checked.

In the second example CHR = the code of the character to be checked for.

U Nalla,
Bolton, Lancs.

Lynx runs PROTECTion racket

Having recently bought a Lynx, I was interested in the letter from G Carter (*PCN, March 25*).

In fact the PROTECT command is explained in the manual on page 55.

The TEXT command seems to combine four functions:

```
PROTECT O (cancels previous PROTECT commands)
PAPER BLACK, INK GREEN
CLS
PROTECT MAGENTA
```

This could be a problem as it will destroy any graphics or text already on screen. It could be adapted by protecting any secondary colour and/or leaving out the CLS and would operate just as fast.

Taking this to its logical conclusion, if you have a lot of number crunching or whatever in the program, PROTECT WHITE could be used. This prevents any printing to the screen so you would need PROTECT (and secondary colour) before any PRINT line.

This is similar to FAST mode on the ZX81.

The GETN command is supposed to return the ASCII code of any key pressed but doesn't really.

Try the four direction arrows (which the manual tells you have ASCII codes of 123-126). These return codes of 12, 22, 11 and 10. Square brackets and the ESCAPE key also give odd results.

Also, when using INK and PAPER there is no need to stay withing the 0-7 number range. Any number you enter will be converted to module 8 and work quite happily.

Perhaps one day a micro manufacturer will tell us these things rather than putting us through the trial and error process.

Chris Tringham,
London SE19.

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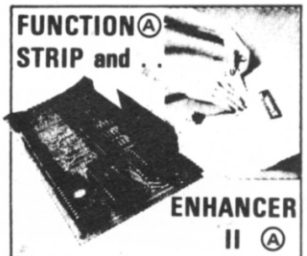

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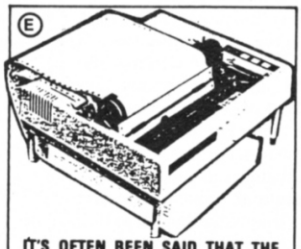

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BBC Basic on an Atom? Reg Parsons finds the BBC ROM card a bit of a spanner in the works.

The Basics in splitting the Atom

When Acorn advertised a ROM card for RUNning BBC Basic on the Atom I quickly placed my order.

I'd taken delivery of the 8K+2K Atom with floating-point ROM a few months earlier, and during the period of learning to drive it became aware of its limitations. I soon fitted a power utility ROM and expanded the RAM via the full Atom complement to an additional 32K off-board Timedata Dynamic RAM card, fitted inside the Atom case.

This was configured to occupy the whole of the lower text space, and provided 38K of continuous RAM. Then I added the 6522 Versatile Interface Adaptor and a printer buffer set.

The Atom ROM card seemed an attractive proposition, even though I knew that less than half the available RAM would be free for use in BBC mode.

When the board eventually turned up I immediately discovered two snags. First, there was no way in which it would fit in its intended slot inside the case while the Timedata RAM card was there. And although the 'Comprehensive BBC-type Basic Manual' gave detailed fitting instructions, it didn't live up to its description — it was inadequate in providing working information on the BBC dialect. Nor was a circuit diagram supplied.

I had to remove the internally fitted memory board and house it externally, with a ribbon cable and socket connection to the external Atom bus. Meanwhile, I ordered a copy of the BBC Basic User's Guide.

When the manual turned up I got down to the business of installing the board and evaluating it from the point of view of — by now — a seasoned Atom user.

When the board was fitted, all the internal lower text-space RAM was removed, including Zero Page, together with IC6, and the connection to pin 12 of IC5 was disabled in order to configure the Atom to use the external board.

These modifications remained, so the IC9 position on the BBC Board was left unoccupied, and in addition, the extra RAM supplied on the BBC board by ICs 5-8 was removed.

I chose to use the keyboard selection option for switching between BBC Basic and Atom Basic. I won't tolerate the incongruity presented by making additional soldered connections to plug-in modules, so I fitted miniature single-pole sockets to the Atom board in appropriate positions, and mating plugs to the flying leads from the board.

Power-up

On power-up followed by BREAK, the BBC Basic banner was displayed. BREAK/CONTROL produced the Acorn Atom banner. To switch back, BREAK/SHIFT at first produced no result, but a second attempt returned to BBC Basic.

So — after the initialisation, BREAK/SHIFT has to be executed twice to attain the desired result; no problem — but nobody said so. BREAK/CONTROL needs only one execution to operate. After executing BREAK only, no change takes place in the operating mode.

My first major discovery was that Mode 7 is *not* Teletext; it is Atom Mode 0. Similarly, Mode 6 = Atom, Mode 1, 5 = Atom 2, 4 = Atom 3, and 3 — 0 are Atom 4. Characters per line remain at 32.

Mode 7 is the only text mode. There is no facility for defining text windows in graphics modes. The cursor remains the Atom cursor, and, although nobody says so, it can be turned off by the command ?&E1=0, and on again by ?&E1=&80 — equivalent to the Atom commands.

The mode equivalents are listed in the supplementary manual, which also says that the graphics screens are scaled, so that PLOT statements refer to the same screen location in all graphics modes. In this context, the screen size is 1280 × 1024.

The Atom character font is used, but the production of inverse characters, representing lower-case letters, is inhibited and they are printed to the screen as normal capitals. This means that a printer will not print lower-case characters. This seems to be due to the fact that inverse characters and block graphics characters are used as key-word tokens in BBC Basic. Acorn says this is because the Atom OS is used by the board.

The number of characters permitted per line when input from the keyboard considerably exceeds the Atom limitation, and appears to be a maximum of 128 characters (four screen lines). After this, entry is allowed to continue up to 240 characters or more, although editing is no longer possible.

A strange feature is that certain shifted characters seem to cause a notional but not physical CR, so that entry again becomes valid.

No statement of the maximum number of characters permitted can be found anywhere, and Acorn will not commit itself to one. The company says that the shifted character anomaly results from the fact that the Atom OS is used.

Mixing modes

When I tried to LOAD an existing program in Atom mode, it failed. A memory test indicated that, in this mode, memory was accessible only up to #4000. This was totally unacceptable, and again I turned to Acorn and also to Timedata.

Acorn told me that the presence of the BBC board in the Atom inhibited the addressing of any off-board Eurocard, even in Atom mode. Not one word to this effect appears in any of its advertisements for the board, and no such limitation is mentioned in the instructions that accompany it.

Timedata carried out a thorough investigation and eventually produced a comprehensive set of notes concerning the use of its boards in conjunction with the BBC board.

The connection to pin 11 of IC14 on the BBC board must be disabled, and that pin must be connected to pin 12 of IC12, also on the BBC board. There is a conveniently located plated-through hole on the BBC board, connected to pin 12 of IC12, and a short wire was soldered from there and

terminated on a single IC socket removed from a DIL unit, which was clipped to the bent-up pin on BBC IC14.

Full Atom memory was now available from 0 to #97FF but, of course, the maximum memory location normally available in BBC mode remained at &4000.

However, by raising HIMEM to &57FF, continuous memory is accessible up to that location. When I asked whether the screen section could be used for Basic programs, as in the Atom, Acorn refused to comment.

I have tried it; sometimes it works, sometimes it doesn't. It's impossible to say why, because when it fails it produces the diabolical BAD PROGRAM error and all is lost. At least it should be possible to store data and/or machine code in this area, but this has not yet been tried.

I am aware that criticism of that error message — or rather of its consequence — is more a criticism of BBC Basic than of its implementation on the Atom, but I still think the action taken is ridiculous, and I cannot think of any logical reason for it.

I suspect that the error occurs on the BBC board for reasons over and above the one defined in the User's Guide. For instance, tidying up a program by adding an END statement will sometimes allow it to make one more run, and then report BAD PROGRAM, and that's your lot. Acorn attributes this to the use of the Atom OS.

The Atom utility ROM has to be transferred to the BBC board and occupies memory space from &6000 to &6FFF. Because of the address contents — if for no other reason — the ROM is unusable and inaccessible in BBC mode, and the valuable address space is wasted. Worse still, Atom COS, which runs at 300 baud, is the only one available in BBC mode.

Since for the last eight months or so I have been *LOADing and *SAVEing all Basic programs as un-named files at 1,200 baud with absolute reliability, I do not take kindly to returning to the tedious 300 baud.

It has been reported that, by careful manipulation of addresses, it is possible to save programs in Atom mode, using the utility ROM Fast COS. To date, I have not been able to do so; this could be due to some unexpected effect of the use of off-board memory.

Acorn's advice is again that this is due to the use of Atom OS. The lack of FAST COS will ensure that very little use is made of the board by me.

Hex numbers could not be INPUT from the keyboard direct to a variable. The answer is to INPUT to a string variable, and make the variable = EVAL (string variable). It seems that this is a standard feature of BBC Basic; nobody says so anywhere.

Command control

None of the BBC *FX commands is available, and the only VDU commands available are those corresponding to the Atom control codes, plus one which places the cursor in a specified position on the screen, and one which mimics the command MODE 3, VDU31 and VDU16 respectively.

If there are others, I have not found them. A nice feature is that VDU can be abbreviated to V.; V.00 is much easier and

quicker to type than P.$00.

Other commands not implemented are ADVAL (understandable because there is no analog to digital converter), COLOUR, ENVELOPE (resulting in severe limitations to the SOUND command), EOF, EXT#, PTR (all because there is no provision for DOS), GCOL, POINT and POS.

Commands only partially implemented are VDU (already discussed), INKEY, INKEY$ (input of negative numbers not supported), SOUND (only one channel and no Envelope parameter).

As has already been implied, the hex operator is '&' instead of '#'. The latter is used in the assembler to denote immediate addressing mode instead of '@'.

The following OS routines do not exist: OSGBPB and OSARGS. OSRDCH and OSASCI appear to be implemented by Atom's OSWRCH. OSNEWL has also disappeared, but its limited functions are obviously absorbed elsewhere.

VDU21, besides its normal function (P.$21), deletes the whole of the current line up to 128 characters in length, during program entry only.

Most keywords can be abbreviated on entry, but these are printed in full when listing; this makes them *less* readable, as does the use of variable names — which is not only permitted but positively encouraged by BBC Basic. Variable names are extremely wasteful of memory space, and I cannot understand why they should be so encouraged.

Long before computers existed I was taught to allocate letters or alpha-numeric combinations to variables. While I concede that variable names may have a limited use, I shall continue to use alpha and alpha-numeric variables.

In general, BBC error codes, except for the BAD PROGRAM abomination, seem to be more helpful than their Atom equivalents, but there is one message that is not only useless but a nuisance. When LISTing in BBC mode, Atom OS as usual is used, and exit from the List is by ESCAPE. BBC Basic prints out the unnecessary message ESCAPE AT LINE 00, and in doing so, it scrolls the listing up, by up to three lines — not disastrous but irritating and time-wasting. Acorn says that the message cannot be inhibited and that it is due to the use — you've guessed it — of the Atom OS.

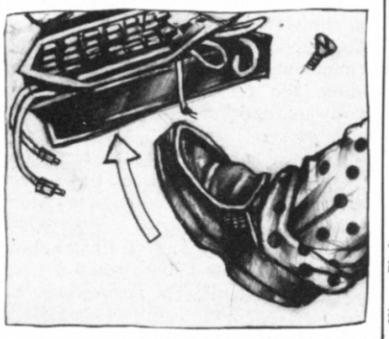
There is a 'bug' in versions of the ROM that pre-date December '82, which causes a LINE FEED to be sent to the printer. This results in undesired double-line spacing in some printers. Line feed to the printer, says Acorn's technical department, can be inhibited by the command ?&FE=0.

Acorn says that user-accessible vector addresses are the same as Atom equivalents. They refuse to supply information on Zero Page addresses, which they say is not available.

Positive points

Despite all my criticisms, however, there are desirable features.

Print formatting is a pleasant feature after the Atom's almost total lack of any such facility, as is the implementation of 'proper' string handling, and the total independence of string variables on integer variables. The freedom of choice in selecting both integer and FP variables is a



Kieren Phelps

welcome innovation, as is the freedom from the need to dimension strings before use.

Many of the more useful commands, such as DEL, ELSE and ON ERROR already appear on most of the utility

ROMs and will not be new to Atom users.

DEF and the associated FN and PROC are potentially useful, but as yet I have not experimented with them, and because they open up a totally new programming concept I am reluctant to do so.

No doubt, though, that reluctance will be overcome given time.

PAGE is a welcome simplification of the ?18=#00 routine.

CHAIN, which will accept an empty string as its argument, and which is equivalent to ATOM's *RUN without the hassle, is a potentially useful command, but it is restricted in its usefulness by the lack of FAST COS.

Overview

The BBC board for the Acorn Atom is an excellent idea, potentially of great value and interest to Atom owners. But the

project has brought forth a half-baked product.

I accept that the Atom can never be a BBC micro. Nevertheless, with a little more dedication on Acorn's part it could have been much closer to it than it actually is.

There is room in the memory map, and even a socket for an extension OS ROM. Also the space occupied by introducing the Atom utility ROM into the BBC memory could have been usefully employed in extending the OS.

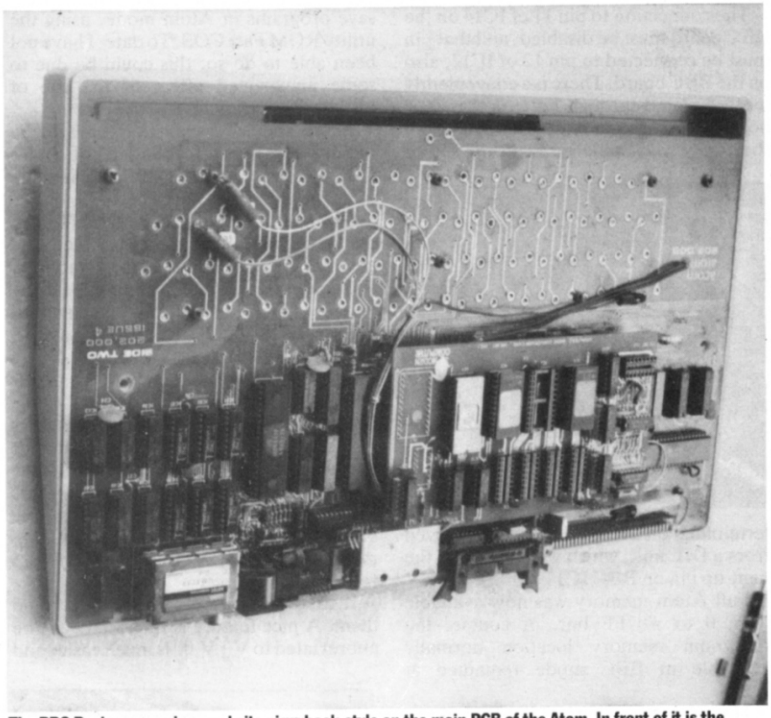
Acorn says it has no plans for any extension at the moment.

In the final analysis, everything depends on the view one takes of 'BBC Basic'. Acorn appears to consider that it should be a minimum implementation of the dialect within the limits of Atom's existing hardware, and indeed the company virtually says so.

I believe it should be the maximum possible implementation of the dialect within the physical limitations of the Atom — a very different thing.

The crunch question is 'If I had known then what I now know, would I have bought the board?' The answer must be No.

If you are considering buying it you must form your own conclusions. If you have a fully expanded Atom (12K+12K with VIA) and no intention to expand further than the BBC board, then it may be just what you are looking for. Otherwise, be warned.



The BBC Basic conversion card sits piggyback-style on the main PCB of the Atom. In front of it is the back of the keyboard, so the entire assembly is actually upside-down in the case. A few jumper connections are necessary.

There's life in the Atom yet

Acorn's Atom has more recently been overshadowed by its grander TV-star relation the BBC micro, but it's a fine little micro in its own right.

For only £174 you get a full-travel keyboard, between 2 and 12K of RAM and a 6502-based processor. You also get one of the fastest (but most idiosyncratic) Basics around, and enough programmable I/O to satisfy anyone.

Of course, it isn't all milk and honey. For example, there isn't enough space inside the case to take any more than a couple of the available expansion boards, and one in particular, the colour card, generates too much heat for the rather inadequate ventilation.

That said, the Atom is a very 'open' machine, meaning that (provided you can get the information) there are no tricks preventing you from programming it to do anything you want.

The lack of memory will limit how much code can be squeezed into the little box, but tight programming can make it fit. The system has also been available to run Acorn's Econet since last year, but since the development of the BBC it isn't much used for that purpose.

The Atom was in many ways a test vehicle for a lot of the facilities now offered on the BBC micro. For instance, Econet was first configured on the Atom more than a year and a half ago, using much the same system available for the BBC. In fact, the Atom is still used as a control keyboard for the System 5 file server system on a large BBC micro Econeted system.

Although the Atom is likely to become obsolete with the development of the Acorn Electron — the company's next under-£200 micro — it will remain until then one of the better-equipped machines in that price range.

Looking much like an anonymous Commodore Vic-20, the Atom has only 60 keys and those used for the cursor. It is not equipped with quite the range of graphics keys available on a more modern machine such as the Vic.

Colour problems

The Atom has also suffered from problems in implementation of colour. Atom colour card's VDU driver chip, 6847, was originally designed to be used on an American colour system and has proved difficult to use on PAL systems. Unless modifications are made, it is also frustrating for use with RGB-type monitors.

The BBC micro has solved this colour problem by offering RGB, PAL and composite video signals as standard outputs.

Although it is not expected to be used with disks as often as the BBC micro, the Atom can accommodate a disk drive. An Atom disk drive pack from Acorn will give you 92K of storage on a standard 5¼in single-sided 40-track floppy disk using an Olivetti disk drive with its own separate power supply.

Unfortunately, the disk pack costs almost twice the price of the micro, which is likely to keep most Atom owners from using such a drive. **GW**

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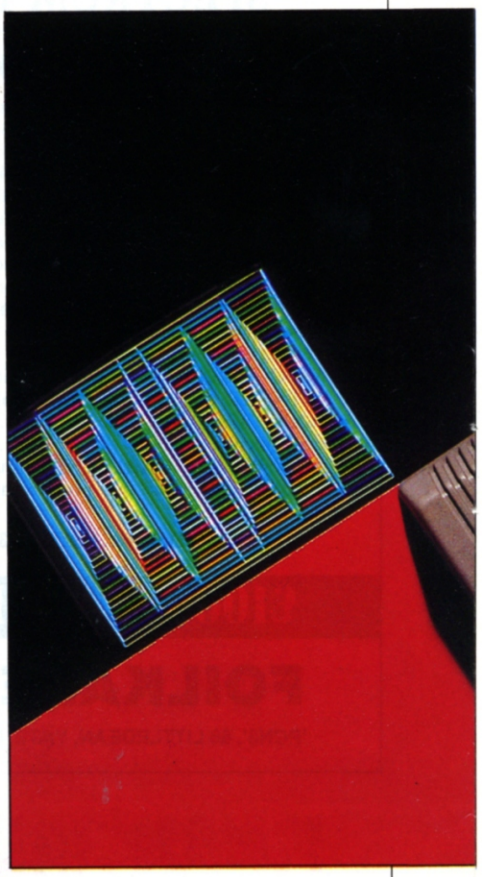


The Lynx has almost unrivalled colour graphics. It's just that getting the most from them can prove difficult. The standard machine has eight-colour 256 × 248 graphics on a 40-column screen, and there's a promise that memory upgrades will soon double that to 80 columns and 512 × 248 graphics.

Everything about the Lynx display is done in software. So, as well as standard line-drawing facilities, the Lynx can perform tricks such as user-defined characters, sub and superscripts, double height characters and so on. As with many micros, it's possible to squeeze a few extra colours out of the Lynx.

A standard graphics character, code 242, is a chessboard pattern. Pick the right foreground and background colours with PAPER and INK, PRINT CHR$(242) and the closeness of the dots gives the impression of another colour. Red and yellow produce orange, yellow with GREEN and CYAN gives another two shades of green and so on. Remember that you are limited to the 40 × 24 character blocks when using these colours.

Making colours vanish, not appear, is one of the machine's unique features. The Lynx uses three separate banks of memory to remember what is on the screen, one for each base colour red, green and blue. Using the PROTECT command, you can disable any or all of the banks and thus prevent particular colours from being written to or erased from the screen.

This is more useful than it at first seems. Its main use is that it makes programs faster. If only one of the banks is working, then the Lynx has less to do when you write to the screen. So you can write reasonably quick animated graphics in Basic.

PROTECT also allows you to draw a background in one or two colours, PROTECT it and then move objects over it without disturbing it. Again, useful for animation.

The extremes of PROTECT are easy to understand. PROTECT BLACK switches all the colours on. PROTECT WHITE disables all the base colours and hence disables the screen.

In between, PROTECT has some odd effects. If you have set PROTECT CYAN, then green and blue are disabled. Yellow is made up from red and green but try to write in yellow and you get red . . . because green is switched off.

Figure one shows what colours actually appear on the screen with INK and PAPER after particular PROTECTs have been executed.

The Lynx supports a complete set of control characters to do everything from double-height characters to beeping the screen. These can be used with PRINT CHR$, VDU or built into strings using CHR$ and +. They are straightforward to use but there are a few traps.

All the sub and superscript characters do is move the cursor down and up three pixels respectively. So to print the chemical formula of water, you use PRINT "H";CHR$(29);"2";CHR$(28);"0";. But be careful — any text immediately on the line below the subscripted text will overwrite the bottom of the subscript. So finish the subscripted line with CHR$(31).

To make best use of these control codes, you really need to use them with your own defined characters. These are the easiest ways to produce spectacular graphics.

The Lynx manual provides an easily used and reliable method. But it's not perfect. It involves a lot of typing, and there are problems with using the HIMEM and RESERVE command to make space for the characters.

Protected / Selected	Black	Blue B	Red R	Magenta R+B	Green G	Cyan G+B	Yellow R+G	White R+G+B
Black	Black	Black	Black	Black	Black	Black	Black	—
Blue	Blue	—	Blue	—	Blue	—	Blue	—
Red	Red	Red	—	—	Red	Red	—	—
Magenta	Magenta	Red	Blue	—	Magenta	Red	Blue	—
Green	Green	Green	Green	Green	—	—	—	—
Cyan	Cyan	Green	Cyan	Green	Blue	—	Blue	—
Yellow	Yellow	Yellow	Green	Green	Red	Red	—	—
White	White	Yellow	Cyan	Green	Magenta	Red	Blue	—

Figure 1 — shows the colour that actually appears when a particular colour is selected using PAPER and INK and a particular colour is PROTECTed. A dash indicates that nothing appears.

Ian McKinnel

If it's done in the program, it gradually reduces all the available user memory. If it's not in the program then you can't really trust the user to type it in.

There's a much quicker (and cruder) method that can handle up to 70 user defined characters at once. First convert the binary character definitions into hex. If that's a problem, use PRINT#BIN(X) where X is the binary number. Put a CODE instruction somewhere in the program, perhaps at line 1000, and then simply type all the hex bytes after in sequence. All the definitions must fit on one CODE line. After that, add a DPOKE GRAPHIC, LCTN(1000) line to the program and RUN it.

Hey presto, instant defined characters from code 128 onwards. Now suppose you wanted more sets of 70 characters. Add them on different CODE lines and use DPOKE to switch between them.

As an example, try a skinny space invader. Lynx characters are defined on an unusual 6 × 10 grid and are often better used in pairs. Enter and run this:–

1000 DPOKE GRAPHIC, LCTN(1010)
1010 CODE 00 1E 2D 2D 3F 1E 0C 12 21 21

Altering GRAPHIC usually messes up the cursor character, and CCHAR &2080 will set it to the invader you've just defined.

There are lots of ways of animating such characters. The standard technique on most micros is to define a shape spread across two characters, in a series of positions, each a pixel to the side of the last. Printing the characters in sequence slides the shape across from one character column to the next. On the Lynx, the PRINT@ command works to a 2-pixel level. So it's already got smooth character animation.

To get the appearance of life in the characters, it's easy to alternate between two slightly different versions of the character. Edit line 1010 and add the bytes 00 1E 2D 2D 3F 1E 0C 12 0C 0C.

This defines the same invader as above but with its legs closed. By keeping the invader in a string array and using a flag to alternately select between the two versions, it's easy to walk the invader across the screen . . . try the program in Figure 2.

Combining user defined characters with control codes builds strings that produce very complex graphics when printed, and the strings can also set the colour.

Define a Diamond using 00 0C 0C 1E 3F 3F 1E 0C 0C 00 and character 128. Set A$=CHR$(2)+CHR$(7)+CHR$(2)+CHR$(2)+CHR$(2)+CHR$(128)+CHR$(2)+CHR$(0)+CHR$(1)+CHR$(7). PRINTing A$ produces a playing card diamond.

You can even build multi-coloured characters. Define each of the different coloured bits as separate characters. Set the overprint on (CHR$(21)), set the first colour and print the first part of the character. Then print a CHR$(22) to move the cursor back one character, set the next colour, print the next piece and so on.

Another simple dodge is to use strings that appear to be animated when you PRINT them. It can be useful for explosions, or perhaps for waving the arms on some alien creature. Define the separate characters needed for the animation and then join them together separated by backspace characters. PRINTing the string flashes through the various characters in sequence. If it goes too fast then you can slow it down by adding in dummy characters such as a space then a backspace then a space then a backspace and so on.

Using user defined characters in this way is a good way to produce fast, complex graphics in Lynx Basic.

There's no reason why you can't use the rather limited set of ordinary drawing commands to produce backgrounds, title pages and so on. And then you can use the user defined characters with PROTECT to produce fast animation during play. The Lynx has its serious side. But it can be a great deal of fun.

Figure 2

You can put life into your screen characters by trying this program. By alternating between two slightly different versions of the character, you can make it wave its legs — your first step in animation

```
>
>
>
>
>
>
>
>LIST
   10 CLS
   20 DPOKE GRAPHIC,LCTN(1010)
   30 DIM A$(2) (2)
   40 LET A$(0)=" "+CHR$(128)
   50 LET A$(1)=" "+CHR$(129)
   60 LET F=0
   70 FOR X=0 TO 118
   80 PRINT@X,60;A$(F);
   90 PAUSE 500
  100 LET F=ABS(F-1)
  110 NEXT X
  120 PRINT@X,60;"  ";
  130 GOTO 70
 1010 CODE 00 1E 2D 2D 3F 1E 0C 12 21 21 00 1E 2D 2D 3F 1E 0C 12 0C 0C
```

How to tune up your Apple to synthesiser quality at a sweet and low price, by Richard King

Music micro please!

The Apple II microcomputer was one of the first machines to have a loudspeaker directly controllable from a program, and it was not long before several rudimentary 'music programs' were circulating among enthusiasts. A few even went on sale.

These mostly were some kind of 'jukebox' which would play a selection of tunes. The results were mostly awful.

In general these programs used a form of 'piano' programming — the user entered notes by pressing keys, using either their musical names, or a keyboard mapped by software onto the normal character-keyboard.

The notes were stored as they were entered and could be played back, but editing was either non-existent or so crude that it wasn't a lot of fun.

Pseudo languages

Rather better were the pseudo-languages which allowed you to define the musical sequence as a file, which was then read, interpreted and played. This permitted a more sensible system of naming for the notes and their parameters.

Such programs were not real computer languages. They were more precisely systems which had certain features in common with languages, but were adequate for making some kind of noise which was not too painful to listen to.

Their direct descendants are Forte from Softape, and the Electric Duet by Insoft. Both operate as pseudo-languages and have a jukebox mode, although the Electric Duet also has a piano mode.

Forte is the better of the two, since it has structures which allow conditional tests and loops, much like a real language. The Electric Duet has a handy Transpose command, though, and the method of sound-generation is such that it sounds as though there are two voices playing simultaneously.

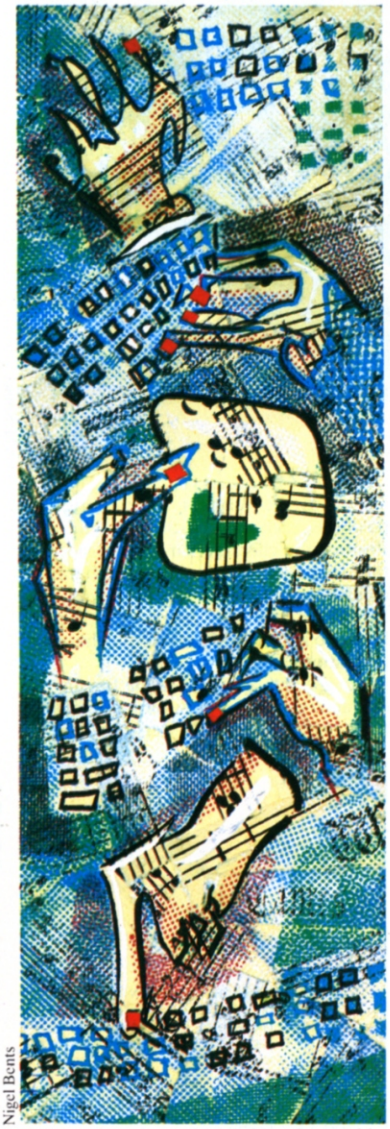
Sounding boards

A more effective method of sound generation is to use one of the hardware boards available. These cost between £100 and £250, depending largely on the method the board uses to make noises, but also on the software supplied.

Easiest to use are the ones which don't use processor time — this requires the board itself to have some processing ability. The best examples are the Zapple or Mockingboard.

These use the General Instruments AY-3-8912 or −8910 programmable sound generators. This type of chip is almost as smart as a real CPU, and can make a sound which may last for several minutes.

To use these boards the program merely has to store parameters for waveform and frequency into the chip, one pair for each of the three channels. A fourth, white noise, channel may be mixed into any or all of the other channels. The last step is to set the envelope parameters for shape and frequency.

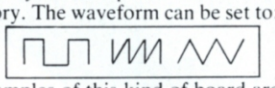


Nigel Bents

The programmed sound is triggered by setting the volume on each channel, and the programmable sound generator takes care of things until either the sound dwindles to nothing, the volume registers are reset to 0, or the PSG is retriggered.

Conversion chip

Another method is to use some kind of digital-to-analog conversion chip, which can be programmed to read a set of frequency/volume pairs from a table in memory. The waveform can be set to:-



Examples of this kind of board are the ALF synthesisers. Unfortunately, this method seldom allows more than three voices, and because of the limited selection of waveforms will inevitably sound a bit buzzy. It also has the disadvantage that it puts a heavy load on the CPU.

Much more sophisticated is the Mountain Computer music system. This is also pretty clever and, provided valid information has been stored in the right place, can play complete symphonies unassisted. Not only that, but it has 16 separate voices, each of which is fully programmable.

The waveform on a single voice may be made very complex, or several simpler waveforms may be combined to produce dynamically changing sound. Since it uses DMA to read the data, the CPU is free.

Interrupts may be generated by the board so that the CPU may choose to play another table, after the waveform, raise or lower the volume either overall or on one channel only, or even change the tables dynamically, which will give very real-sounding notes.

Additional hardware may be used to improve the efficiency of the system such as the Soundchaser or alpha Syntauri keyboard controllers, which add a full musical keyboard to the machine.

Real instrument

When the full software is run with such a setup, the Apple becomes a real musical instrument, fully capable of producing concert-quality output. The software allows the user to define a waveform or envelope, enter the music either as musical notation (complete with accents, dynamics and so on), or directly from the keyboard.

To give some idea of the power of such a system, compare it with a professional synthesiser of similar ability.

The Synclavier, made by New England Digital, is a fully digital 32-channel synth. It has a 68000 processor and an 88-note keyboard. To get complete control over waveforms and so on, you have to add a DEC VT 100 terminal and Scientific XPL, a very high-speed language, or a special package written in it.

The cost of this lot comes to some £35,000. Not exactly budget-priced, but this is a mind-boggling machine. On the other hand, an Apple II, the Music System, keyboard and controller and some controlling software will give half the number of voices and much the same capabilities at a cost of about £2,000.

Overall, the best-sounding, most flexible system is the Mountain Computer system.

Details of these and similar products are available from the larger Apple dealer.

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'Learning to use the ZX Spectrum Computer' by Robin Bradbeer, published by Gower at £5.95 (paperback, 76 pages)

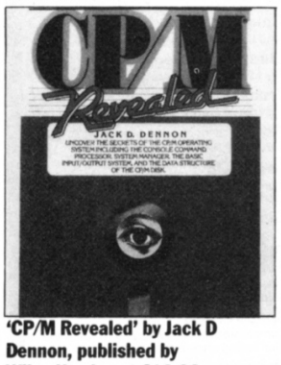
This book outlines the ways in which Sinclair Basic can be used to exploit the capabilities of the ZX Spectrum in just 76 pages. The user manuals take 262 pages.

Manuals are usually a neglected component in the typical micro package. In this case, however, the publication of an alternative guide cannot be interpreted as an indictment of the manufacturer's own offering.

Its author, Robin Bradbeer, co-wrote the introductory booklet and edited the programming manual for Sinclair.

If you have a Spectrum, find the documentation reasonably useful and want to move on to bigger and better things, this is not the book for you. But if you find the manual difficult to understand, the same information couched in different terms may shed a little light.

The book would certainly serve as good pre-investment reading for prospective Spectrum owners. **IS**



'CP/M Revealed' by Jack D Dennon, published by Wiley-Hayden at £10.90 (paperback, 180 pages)

'No experience necessary' declares Jack D Dennon to set you at your ease from the start.

He might add: 'Large amounts of desk space vital', for *CP/M Revealed* requires you to sit at a micro and consult five other manuals.

But don't be daunted. Dennon aims for clarity, and he uses other sources to back this up. Even so, his description of a cursor in the opening pages might strike even the greenest as patronising.

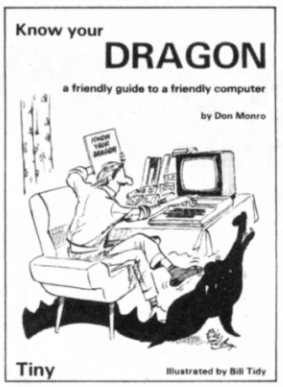
He also has a tendency to show how but not why. This makes theoretical explanations mercifully brief but occasionally baffling.

For example, having mastered the cursor you are led into a beginner's guide to Basic, which unaccountably lurches into commands that you might well manage to avoid for years.

But this is a practical book. Every step it takes can be mirrored on screen. As the book progresses Dennon warms to his subject and gives very lucid treatment to complex matters.

Where a comprehensive coverage of the options offered by CP/M would be too long, he sticks to brevity and points out where to find the full story.

But *CP/M Revealed* is as good as its word and is a book to spend time with. **DG**



'Know your Dragon' by Don Munro, published by Tiny at £5.95 (paperback, 188 pages).

Dragon users will love this book, if only for the Bill Tidy cartoons that pepper the text.

Illustrations apart, this is a remarkably lucid and enjoyable exposition of how the Dragon works.

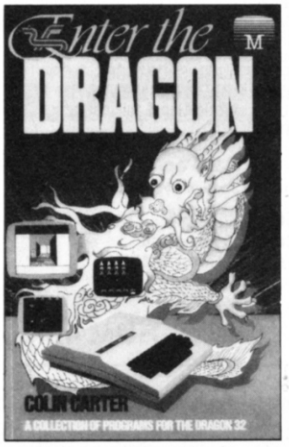
Don Munro wrote the book in Switzerland 'while I was laid up with numerous injuries and the rest of my family skied'. The mountain air has inspired a book that is understandable for first-time users without talking down to those who have a grasp of Basic.

Functions, loops, strings and arrays are well covered, as are the Dragon's sound and colour capabilities.

One aspect I really liked was the generous use of sample programs to supplement the explanations — 95 in total, obtainable on cassette from the publisher at £6.50.

Equally useful is the appendix which acts as an easy reference guide to Basic statements, system commands and library functions.

The book is subtitled 'a friendly guide to a friendly computer'. Users of the Dragon will not find this book a disappointment. **RB**



'Enter the Dragon' by Colin Carter, published by Melbourne House at £5.95 (paperback, 200 pages)

In the old days shops sold things called compendiums, large boxes that held ludo, snakes and ladders, tiddlywinks and the like under one lid.

Colin Carter's book is the modern equivalent. Its 30 programs, games for the most part, will fill many a rainy afternoon. All you need is a Dragon 32 and a steady typing finger to copy Mr Carter's listings from the book to the system.

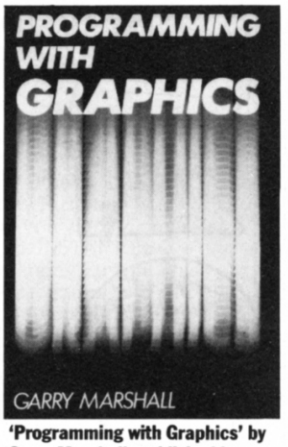
But ludo never pretended to teach you much, apart perhaps from stoicism. *Enter the Dragon* is more ambitious and it is intended to improve your grasp of computing in general and the Dragon 32 in particular.

It begins with an introduction to the machine's keyboard and a couple of tips on procedures.

The contents — program listings of various lengths — are split into sections: general, educational, gambling and so on. There are utilities of a kind in the mathematical and extended application sections, and harmless fun under action, arcade games and strategy.

Before each program the author gives a description and a breakdown of the program's structure and variables. Some have special notes and hints.

You may never have as much fun with ludo again. **DG**



'Programming with Graphics' by Garry Marshall, published by Granada at £5.95 (paperback, 120 pages)

If you enjoy programming the chances are that at some stage you will want to try your hand at graphics.

Garry Marshall's book would be a useful starting point. Avoiding complex mathematics, he steers the reader through the pitfalls and advantages of the different forms of graphics available on micros.

The book, unlike many on this subject, is machine independent. This may cause confusion at first as the Basic syntax used could be different from that on your machine.

However, the approach has its merits as it enables a full description to be given of block, pixel and line graphics in a clear and concise way.

Anyone thinking of buying a micro will find the appendix particularly helpful as it describes the features of the leading machines and their graphics capabilities.

The book really comes into its own with its discussion on how to draw lines, curves and shapes. The text is illustrated with examples and strengthened by the inclusion of Basic sub-routines, which will make graphics programming easier.

Some micro users will find the treatment of advanced subjects like three-dimensional graphics and animation somewhat cursory. They should not be too surprised as the book has no pretensions to being anything other than an introductory text. **RB**

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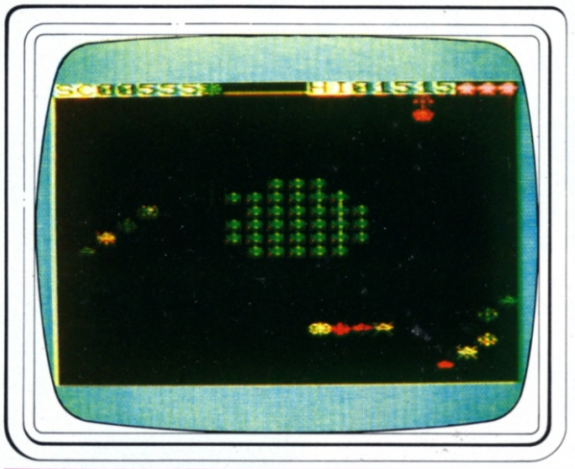


Arcade Action

Battling the bugs

VIC-20

Name: Mangrove **Application:** 'Life'/Shooting game **System:** Vic-20, joystick optional **Price:** £7.95 **Publisher:** Audiogenic, 0734-595647 **Format:** Cassette **Language:** Machine code **Other versions:** None **Outlets:** Mail order high street dealers.

Life, that well-worn classic amongst computer games, has inspired any number of imitations and spin-offs.

Here is one with an added twist for the unexpanded Vic-20, where as well as breeding and dying, the living cells which are the stars of the game must fend off attacks from savage germs.

Objectives

You start the game with a number of cells, and your task is to move around, creating as many new cells in your wake as possible. But while you are busy adding cells to your swamp, they are equally busy being attacked by invading 'germ microbes'.

As soon as all the cells have been wiped out, the game ends.

First impressions

Mangrove comes in either keyboard or joystick versions, both supplied on the same cassette. The packaging is fairly simple.

In play

You move about the screen using a rather peculiar set of keys, if you haven't gone for the joystick option. The letter U takes you up, but you use N to move downwards, F or B to go left, and K to go right. I couldn't fathom out this thinking.

The sound effects include a heartbeat thumping which accelerates as the end draws near — an ideal way of instilling panic in the player, as the inventors of Space Invaders found.

I found that generally, the game doesn't last very long. The 'germ microbes' must carry bubonic plague or something, because they are so effective at flattening your helpless — or nearly helpless — cells.

You do have one defence against the invading microbes — just take a pill. You are issued with three 'smart pills', which will knock out all the microbes on the screen, but like all ultimate deterrents, they need to be used sparingly.

You won't get any more until you have notched up a score of 5,000 points for cells added, so you really have to plan your game ahead.

Verdict

I asked the kids to try it out, but none of them liked it, and all abandoned it quickly. I think it might be a different story with adult players — the game's apparent simplicity will intrigue a lot of people, and I can see that this is one game which could be very addictive indeed.

Karl Dallas

RATING
Lasting appeal —
Playability —
Use of machine —
Overall value —

Arcade Action

Nuclear round-up

VIC-20

Name: Mutant Herd **Application:** Arcade game **System:** Vic-20, joystick optional **Price:** approx. £24.95 **Publisher:** Thorn EMI, 01-836 2444 **Format:** Cartridge **Language:** Machine code **Other versions:** None **Outlets:** High street dealers.

Mutant Herd comes as a welcome relief from the laser-bombing space invasions of the conventional arcade game. It is certainly an aggressive game, but it's a bit less mindlessly savage than the average alien shootout.

Here, at any rate, you have to herd hostile creatures around the screen rather than slaughter them wholesale.

Objective

A swarm of scurrying mutant entities must be herded away from their objective — a pulsating nuclear powerhouse, in the centre of the screen, whose plutonium they crave.

There's also a second part to the game, in which you must destroy the burrows and queen of the mutant herd. One or two players can take part.

First impressions

Mutant Herd comes as a ROM cartridge to slot into the expansion port of the Vic. It's supplied in Thorn EMI's standard big, chunky plastic box.

In play

Like most games of its type, Herd really needs a joystick to be enjoyed. You can control it from the keyboard, but I didn't find it at all easy to play in this way.

The game was an unmitigated success with the kids who tried it.

They didn't seem to miss the zap-pow violence of the more common type of invaders game and they rated it highly for lasting interest.

Can there be a greater accolade?

There is no way of setting the skill level of the game — it just gets more and more difficult.

In the second part of the game things get harder too. You have a purple mutant-slayer under your control, but this can be expensive because if you manage to guide it off the screen instead of into the burrows, you lose a life.

The sounds are the kind of noises you have learned to expect computerised mutants to make, and the graphics are rudimentary but effective.

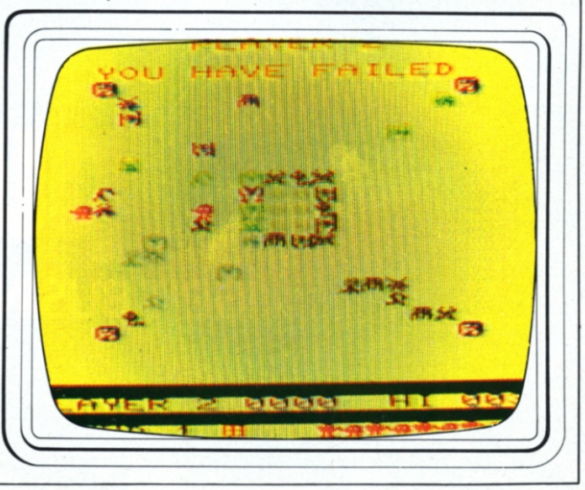
Verdict

This game has pitched it just about right. It's difficult enough to stretch most player' hand-eye co-ordination, yet it is not so difficult that you'll be forced to give up in disgust.

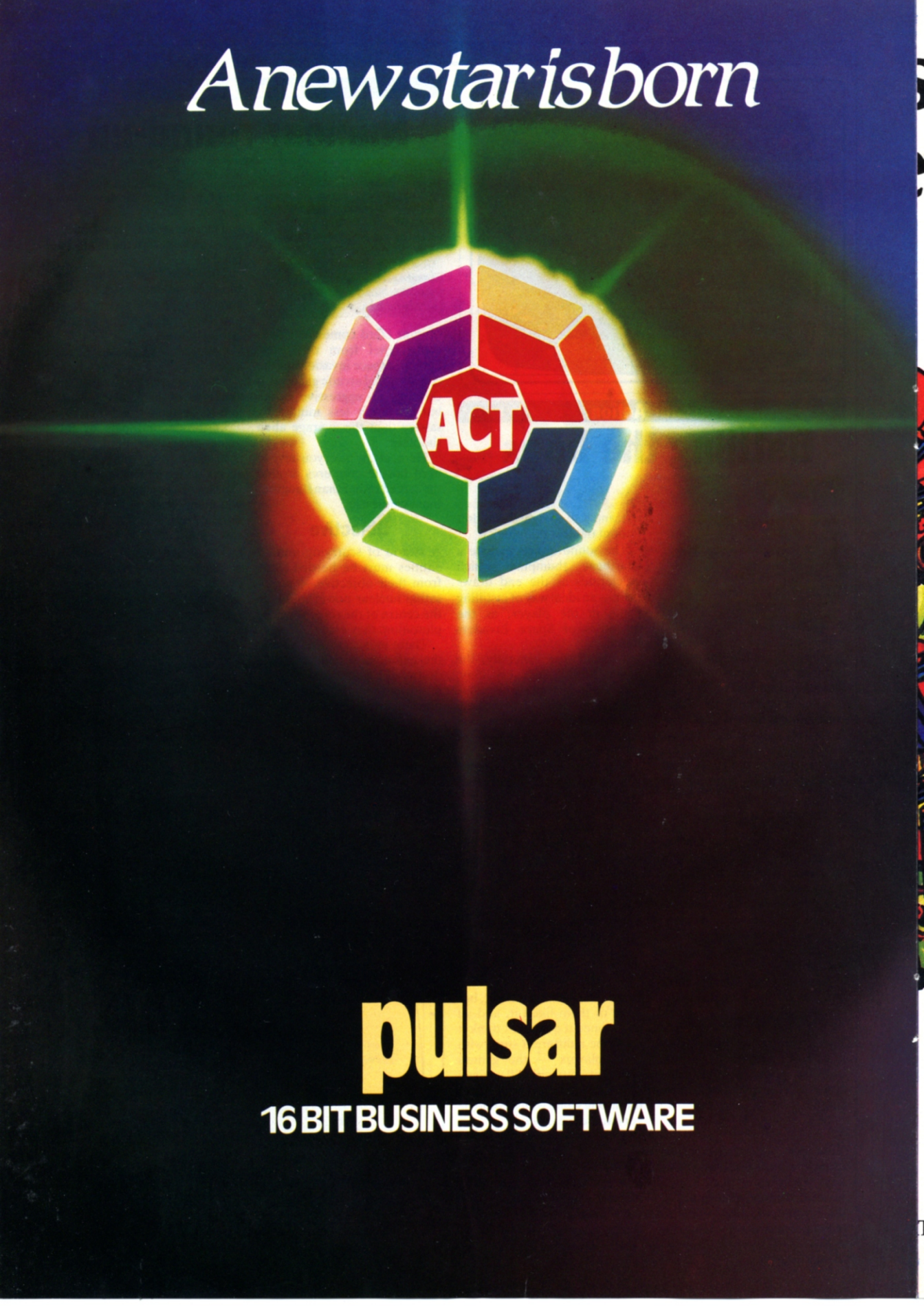
And it is original to have an SF game in which there is almost no death and destruction. It could even become a classic.

Karl Dallas

RATING
Lasting appeal —
Playability —
Use of machine —
Overall value —

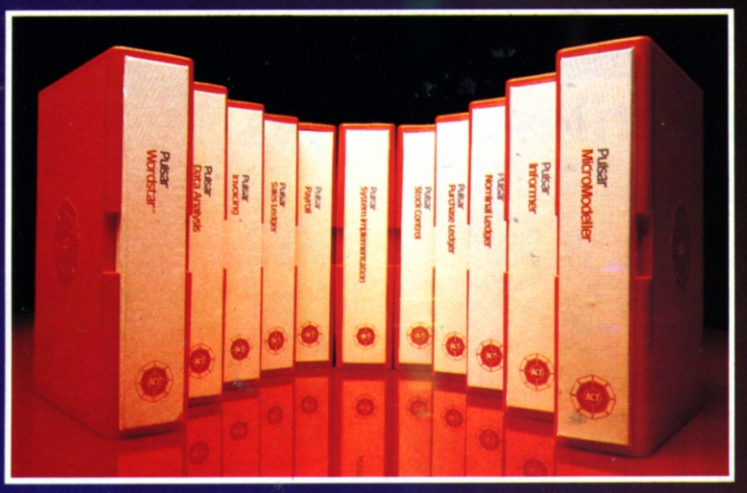


A new star is born



pulsar

16 BIT BUSINESS SOFTWARE



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Compendium

All your favourites

DRAGON 32

Name Games Compendium **Application** Games **System** Dragon 32, preferably with a Joystick **Price** £7.95 **Publisher** Salamander Software 0273-771942 **Format** Cassette **Language** Basic **Other versions** Tandy Colour Computer due next month **Outlets** Mail order, 27 Ditchling Road, Brighton, BN1 4QL, Spectrum, Boots and others.

All your old computer game favourites are here. The Salamander software games compendium presents most of the simple computer games for this micro on one cassette.

From the real world there's horse racing, blackjack and noughts and crosses. From computer folk-lore there's Kingdom, Lunar Lander and Hunt the Wumpus.

These are the sort of programs that people learning to program will eventually write for themselves. So the cassette is a handy shortcut to learning some tricks for neat presentation and so on. The games compendium is a handful of fun but there's nothing on it that would be impossible to do yourself.

First impressions

It's well presented in a library box but the instructions inside are on a shoddy A4 sheet. Only Lunar Lander qualifies for any written documentation — the rest of the page tells you how to run each program.

In play

These are all well-written Basic programs, and several have their moments: you cannot help laughing when a horse keels over in the horse-racing game Donkey Derby. Others call out for better presentation.

Kingdom, in which you rule a country by carefully redistributing your wealth between buying new land and feeding the peasants, has a neat paging facility so that the screen is regularly cleared.

The trouble is, you make all those critical decisions of state just after all the relevant information has disappeared from view!

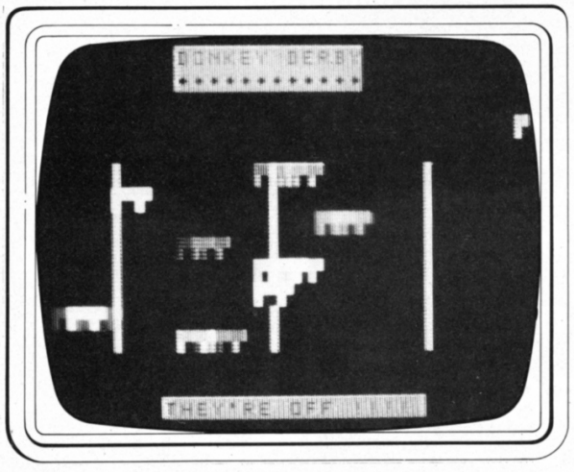
There's a lamentable lack of originality in the games. They're not that much different from their ten-year-old teletype-bound predecessors.

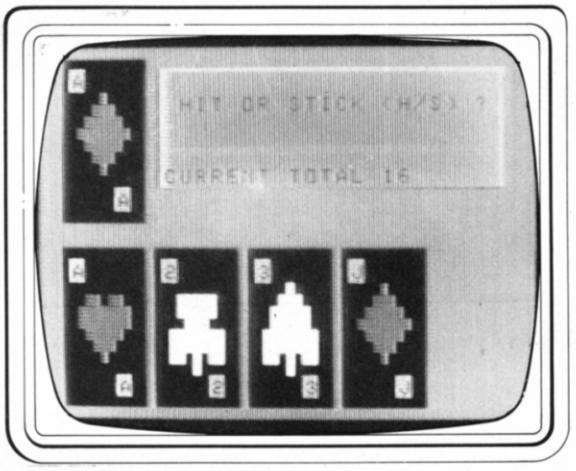
Hunt the Wumpus still consists of tracking a sleeping monster round a dangerous network of caves. It's still played with cave numbers and paper rather than the amazing graphics version Texas came up with for the TI 99/4 micro. Old Wumpus-hunters will have no trouble bagging a few Wumpi and bold ones will still have a lot to learn.

In Lunar Lander you have to land a spaceship on the moon. It is the only reworked program as well as being the only one to dare to use the Dragon's high-resolution graphics. It's surprisingly difficult, particularly as it follows the suicidal Noughts and Crosses program.

Lunar Lander is also the only program on the tape needing a joystick — it's a bit naughty of Salamander not to provide a keyboard option as well.

The program offers various levels of play involving winds, gravity and so on, but I found myself getting a bit suspicious of the mathematics involved, especially when I saw my spacecraft bounce off the side of the screen.





Verdict

The games compendium is a good way to see some of the things computers can do and the sorts of games people used to play with them. It's not a bad idea for people who've just unpacked their Dragon. But don't expect its fun-value to last long.

Max Phillips

RATING
Lasting appeal — 👾👾
Playability — 👾👾👾
Use of the machine — 👾👾
Overall — 👾👾👾

Card game

Going it alone

SINCLAIR SPECTRUM

Name Patience **Application** Card game **System** ZX-Spectrum, 16K **Price** £5.95 **Publisher** Haven Hardware 094 686627 **Format** Cassette **Language** Basic **Other versions** ZX81 due next month **Outlets** Mail Order, 4 Asby Rd, Asby, Workington, Cumbria.

Playing Patience on your Sinclair Spectrum sounds a little odd. After all, a computer game is supposed to provide opponents and team-mates when the real thing is in short supply. But the Haven Hardware patience cassette doesn't play by itself. It merely acts as a hi-tech pack of palying cards.

Objective

Patience plays an ordinary single-pack Carlton, the patience most people play. The cards are dealt into seven columns with the base of each being face upwards. The idea is to build up the four suits in order, uncovering hidden cards and incorporating the remainder of the pack as you go.

First impressions

The cassette comes in a sealed polythene bag with a scruffy A4 instruction sheet. One side of the cassette has the title typed on a small label and glued in place. The instruction sheet proudly names Haven as the winner of the *Daily Express*/Philishave award. It couldn't have been for presentation.

The program itself is a much more professional product. There's a separate 'leader' program to check that the Spectrum is loading all right.

In play

The program presents a tidy card table, the cards being shown as 1 to 9, J, Q, K and A followed by their suit. It is usable in black and white but you lose the red of hearts and diamonds.

Playing it is simple. You specify where you want to move a card from and to by pressing its column number, P for the pack or S for the suits box. The Delete key is disabled, so if you make a mistake you must think of an illegal move in order to correct it. Haven lets you replay a game from the start without shuffling the pack, so you can

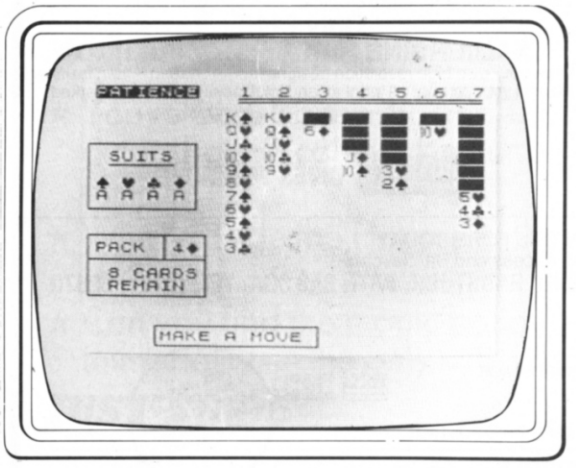
have several attempts at a rotten hand if you need to. And that's all there is to it.

Verdict

Computerisation has brought two major changes to patience. It's harder to cheat, though Haven make the game easier by letting you turn through the pack an unlimited number of times. And you don't have to waste time shuffling and straightening out columns of cards. It might be an interesting demo if the program played itself. But as it stands, it's an odd way of passing the time.

Max Phillips

RATING
Lasting appeal —
Playability —
Use of the machine —
Overall value —



3D board game

Every way but lose

DRAGON 32

Name Vulcan Noughts and Crosses **Application** Game **System** Dragon 32 **Price** £7.95 **Publisher** Salamander Software 0273-771942 **Format** Cassette **Language** Basic **Other versions** Tandy Colour Computer due next month **Outlets** Mail order, 27 Ditchling Rd, Brighton, BN1 4QL; Spectrum, Boots and other dealers

It doesn't take a great mind to figure out Vulcan noughts and crosses. It's that old computer classroom favourite 3D noughts and crosses. The only novelty about the Salamander version for the Dragon is that the company appears to be confused between an old board game and the way Mr Spock used to play chess.

Objective

The game is played on a 4 × 4 × 4 cube, displayed on the screen as four planes of 16 squares.

The objective is to make a line of four points in any of the possible directions. The program is sensibly protected from keying errors.

First impressions

This is a very competent version of the game. It comes in an impressive library case complete with a colour cover pic. Hidden behind this is a scruffy photocopied A4 sheet proudly titled Instruction Manual. The instructions vary from being rather obvious ('Place the cassette in the cassette player') to omitting to mention the object of the game.

In play

As with most 3-D games of this type, Vulcan Os and Xs' biggest weakness is in its design.

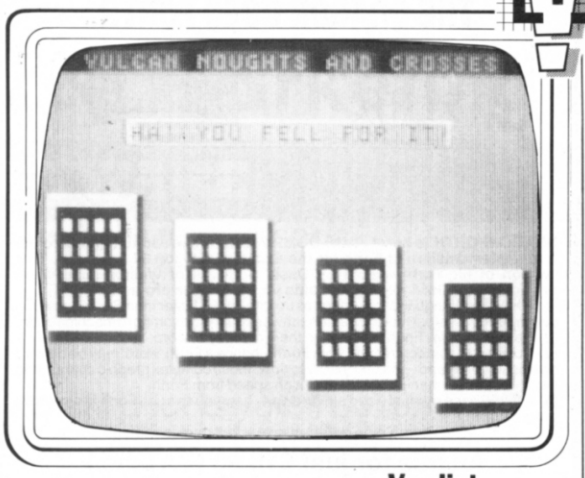
Noughts and crosses are entered on four separate adjacent grids.

It's usually hard to visualise the 3-D effect but, of course, the computer has a 'perfect' representation of the board. The program also falls into the trap of using co-ordinates for moves. It's primarily a game for children and they may have little patience with co-ordinates.

It also falls down on presentation, since the computer's playing pieces can't be seen on a black-and-white display.

Vulcan Os and Xs will play by itself, against you or act as a board for two players. Playing the program involves a frustrating delay which isn't helped by a show of obviously random numbers while it is 'thinking'.

The program plays a simple and persistent algorithm which never misses a trick. You need a fair amount of wit to beat its brute force calculations. But anyone who understands ordinary noughts and crosses and who is prepared to concentrate should have little trouble learning to beat it.



Verdict

It's a less sophisticated version of the game than it could be. But if you fancy a computer game which uses your brain rather than your fingers, this one will give you a run for your money. It's a welcome addition to the thin ranks of Dragon software.

Max Phillips

RATING
Lasting appeal —
Playability —
Use of machine —
Overall value —

Government simulation

Max Characters rules

SINCLAIR SPECTRUM

Name Great Britain Limited **Application** Management game **System** Spectrum 48K **Price** £5.95 **Publisher** S W Hessel **Language** Basic **Outlets** mail order, some retail

As I watched the last of the Labour strongholds crumble, I asked myself, what went wrong? It wasn't as if I'd gone to the electorate on the wrong policy — matter of fact, I'd gone into three consecutive elections on three different wrong policies.

Objective

Great Britain Limited is best described as a government simulation. It's a text-only game where you become the Prime Minister of your choice, representing the political party of your choice.

The program is essentially a budgeting tool — you are presented first with a series of economic indicators, such as the inflation rate, the value of the pound against the dollar, and your accumulated surplus/deficit, then you take it from there.

You levy direct and indirect taxes, allocate resources to social services, and spend money on new housing, schools, youth unemployment and so on. This is done in five rounds, each round representing a year of government. After five years, you must face your less than adoring public. If your policies are really extreme it could be a lot sooner.

First impressions

At first sight, Great Britain Limited seems more realistic than it is. There does seem to be a logical relationship between what you do by way of taxation and public spending and what happens to the economy, but after you've tried a few different forms of government you'll probably find it's fixed firmly somewhere in the economic territory of the 1960s.

What I'd regard as a fair attempt to simulate the progress of the current government,

41►

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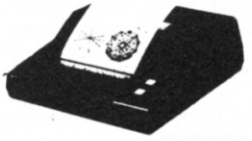

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for example, went wildly off the scale, and Rhodes Boyson — my choice to lead said government — disappeared into the dustbin of history.

In play

But he wasn't the only one. My first effort had been under the guiding hand of the Rt Hon Ken Livingstone. Law and order broke down, and Red Ken's government was thrown out after only one year.

At the beginning of the game, the screen tells you 'INPUT name (max characters 24)'. I took this as a hint, and at the startlingly early age of 24 the Rt Hon Max Characters MP swept to power.

Max's Liberal government (yes, I'd defected) endured for 25 years. His style was cynical — he'd shove up taxation to 40 per cent as soon as he was elected, build up a large surplus at the expense of the groaning populace, then spend it all in the year before the election.

He invariably returned with a landslide majority, despite the fact that his stop-go economic policies stoked inflation up to 2,000 per cent over a 20-year-period. Fags were £60 a packet, and average incomes were around £250,000 a year.

Verdict

The fact that cynicism works is depressing, and it's also clear that no way is Great Britain Limited the Treasury Economic Model. But then if you could run the country on a Spectrum, some whizz-kid would no doubt be doing so.

It is an excellent game, and it passed one crucial test, in that two economists of my acquaintance, although fully aware of its limitations, are still queuing up to play it. You'd best buy it now before inflation pushes software up to £500 a tape.

John Lettice

RATING
Lasting appeal —
Playability —
Use of the machine —
Overall

Adventure

Fleeced in other times

IBM PC

Name: Ulysses and the Golden Fleece **Application:** graphic adventure game **System:** IBM PC, 48K & colour graphics adaptor **Price:** £25.30 **Publisher:** Sierra On-Line **Format:** disk **Language:** Basic **Other versions:** Apple (£25.30), Atari (£28.75, disk) **Outlets:** mail order, various dealers SBD Software, 01-8709275.

Ulysses and the Golden Fleece together in one full colour adventure? Could this game be the first of a long series of slightly wrong double acts, with titles like Jason and the Astronauts or Chinchilla the Hun?

The possibilities are endless, and games writers reduced to hair-tearing despair in their search for novelty will surely move over to this 'King Kong meets Godzilla' approach. Or perhaps they'll bone up on Greek legend before their next epic.

Objectives

'You must become Ulysses,' says the manual. 'Your task, to find the Golden Fleece, and return it to the King. The perils are many, your foes powerful, but with courage, logic, intuition and luck, you can survive and take with you the secrets of sorcerers. Now, sit back, close your eyes, and I'll spin a spell to open time's portals . . .'

The game is for one player, and is set in a number of locations, including the King's town, a tavern, a shop and Colossal Island.

In each of these places you'll bump into people — guards, sailors, shopkeepers — or stumble across objects or treasure to take with you on your quest.

You start off in the town. From there, you can move north, south, east or west. You may speak to anyone you meet, to see whether they have any information which may help you.

Any robbers you meet may steal some or all of your possessions. You may be able to buy something, or you may try, only to find that what you thought was money isn't legal tender here.

The instruction book doesn't tell you much about what you can or can't do — part of the fun is finding out for yourself.

First impressions

The program comes on two IBM mini-diskettes, with an eight-page manual. Having skimmed over its excesses and gaped at its parchment-look pages, I started the game up, to find myself in a small mediaeval-looking town. I roamed about on the mainland for a while — having been told that it was too cold swim — to see the lie of the land.

I managed to find the King's castle, but I couldn't reply to the questions I was asked, and got completely stuck. Usually, you have to type in an instruction — BOW, for instance (I was beheaded once for neglecting to bow respectfully to the King) — and I was trying to reply by typing SAY YES, or REPLY ULYSSES. The log-jam was broken when I gave this up, and just typed in an unceremonious answer.

In play

Each location in the game has its own picture, which comes on screen when you get there. There must be scores of these pictures — in the time I was playing, I found at least 20. If you stumble across some object you can pick up, say a mysterious floating bottle, you just type GET BOTTLE. The item is then added to your baggage and disappears from the picture.

You'll need to use your imagination to find the right commands. I finally managed to find the ship the King had given me, and got on board. But I couldn't get it to set sail until some genius suggested typing CAST OFF, and I was away.

The game certainly has a sense of humour. When I was unable to get any sense from a guard I met, I typed in KILL GUARD. The response was 'That wouldn't be nice. Besides he's bigger than you are.'

Once I was out at sea, things became rather boring; there was no indication of where I was — all the pictures are the same — and I ended up going round in circles. Eventually, I ran into a hurricane, with an island just visible in the murky distance. But whichever way I went, there seemed to be no way to get to it, and I usually ended up either drowned, or back on the deck of the ship in port.

I eventually gave up hope of finding the Fleece, but there were obviously many more places to be found.

Verdict

This is one of the few adventure games available for the IBM PC. Hardened Adventure addicts will no doubt find it easier than I did, but it should present a considerable challenge for most players.

I wasn't particularly impressed with the standard of the graphics — I've seen better on micros such as the Apple or Atari, and this can be laid at the door of the IBM's limited colour graphics. But obviously, only a mad millionaire is going to buy an IBM PC for games. This game, along with others like it, will be played by the boss in the evenings. This could give a new meaning to: 'Working late at the office tonight, dear.'

Only you can decide whether Ulysses and the Golden Fleece will suit you. But it is certainly a game of considerable variety, and, if you succumb to its lures, should keep you happily addicted for some time.

Mike Whitney

RATING
Lasting appeal —
Play ability —
Use of machine —
Overall value —

Philippe Michiels delivers the verdict on the latest Texas micro

Professional standards

Increasing concern about industry-wide standards has meant that big manufacturers — including IBM and Digital — have begun producing hardware running on systems like MS-DOS and CP/M-86. Texas Instruments has now joined the drive for standardised software with the TI Professional.

Texas Instruments selected the Intel 8088 processor in favour of its own 9900 for this very reason, and the result is the Professional — a hardware package that will run much of the industry's bestselling software.

Documentation

The unit is supplied with all the necessary hardware and documentation, right down to the plug, but since it is capable of running more than one operating system, the latter is not included in the basic price. This leaves users with the choice of running their favourite software.

The operating instructions are well laid out in five sections, with a particularly clear guide to setting up the system.

Adequate information is provided for adjusting the display and positioning the separate units for comfortable use.

Diskette handling instructions are well explained, and the use of each key on the keyboard is well documented.

Once the system is set up the diagnostic diskette (which is supplied as standard) runs a comprehensive diagnostic test right down to testing each key.

Construction

The Professional itself comes in three parts — the system unit, the keyboard and the monitor. The system unit is large for a desk-top, measuring 48×43×14.5cm. It is metal-cased, and feels heavy and solid.

There is a large illuminated power switch at the side of the case, but there are no other controls, and there is no external fuse or reset switch.

The unit is fan-cooled, but the fan is excessively noisy.

Removing the top cover — by means of two screws — reveals a sealed power supply, two 5¼in disk drives and the motherboard. The motherboard has a video controller card installed in one of the expansion slots. The review machine also had an expansion RAM card installed. The construction was of a high standard, and all interconnecting cables were neatly tucked away. All connections are made at the rear.

The motherboard contains the Intel 8088 microprocessor running at 5MHz; the floppy disk controller, capable of controlling four drives; 64K of single bit parity checked memory; the keyboard interface; a parallel Centronics printer interface and the expansion interface.

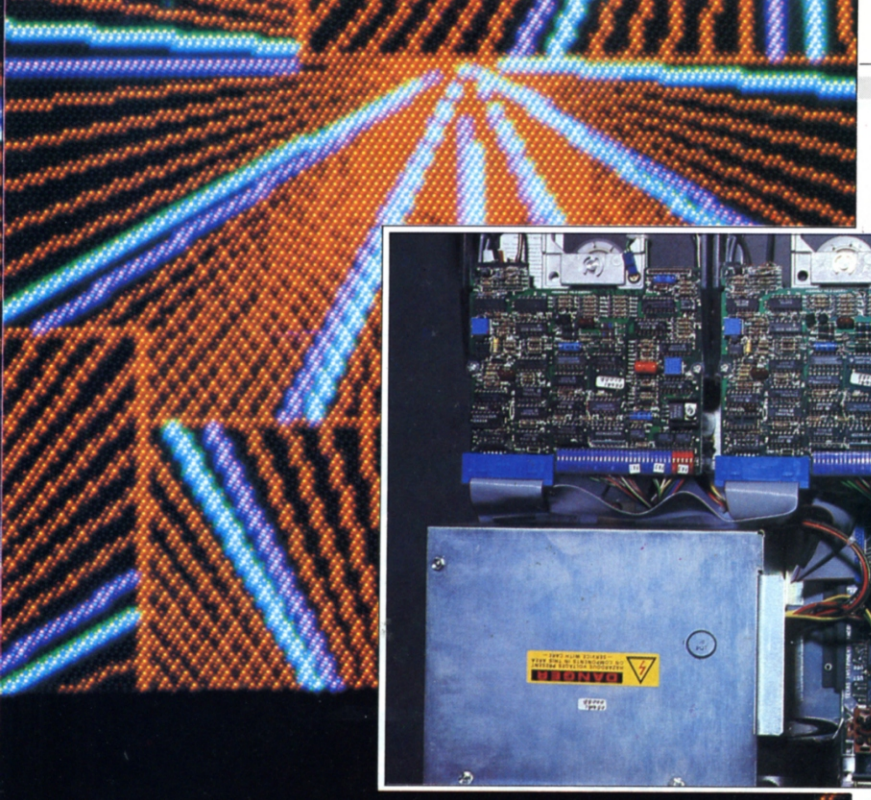
Expansion

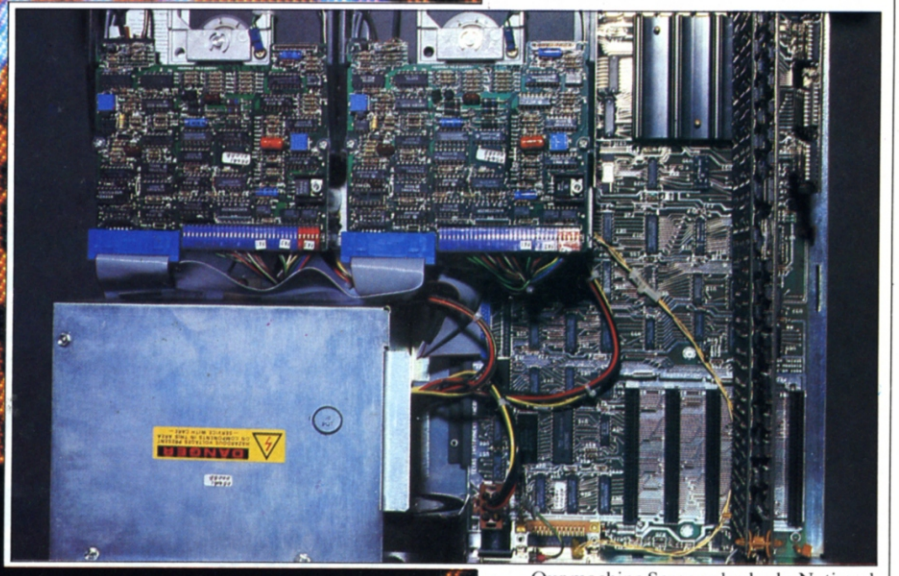
Although there are six expansion slots on the motherboard only five may be used for peripheral expansion. The sixth slot may only be used for RAM expansion.

The review machine was installed with a 192K card, but a 512K card is planned.

One of the expansion slots is required for the video interface card, and this is available in a number of configurations. The minimum configuration is a text card and contains no graphics capability. This card may be expanded to full colour graphics by means of a 'piggyback' card.

The review machine also had the full colour graphics option and with this in place the TI Professional still has room for four expansion cards.





Inside the Professional: the huge PSU dwarfs the disk drives at the top. On the right are the expansion slots.

Ian McKinnell

Our machine Screen also had a National Panasonic colour monitor. When the monitor was placed on top of the system unit, which is the most desirable position, the display was unsteady. When it was placed away from the system it gave a perfectly acceptable display.

Texas Instruments says this was because it was a US monitor, and that production units certainly will not suffer from this problem.

Controls are provided for brightness and horizontal centring and the screen had good anti-glare properties.

The graphics resolution is 720 pixels horizontally and 300 vertically, with a maximum of eight colours, or eight grey levels on a black and white monitor.

Keyboard

The keyboard is connected at the rear of the system unit by a rather thick coiled cable. It has a tilt adjustment but when used on smooth surfaces tended to slip.

The keys themselves have a positive action and are pleasant to use, although I thought their travel was too great. The keys are switchless and should provide trouble-free operation for a long time.

The machine has a low-profile sculptured keyboard, well laid out with 12 programmable function keys, and separate numeric and cursor control cluster.

Software

The MS-Basic supplied with the review machine had some interesting features. When Basic is started the function keys are loaded with reserved words allowing single key program entry. The ALT key allowed single-key reserved word entry.

Program editing was relatively easy since Basic allows you to place the cursor on any visible portion of text for rapid

46 ▸

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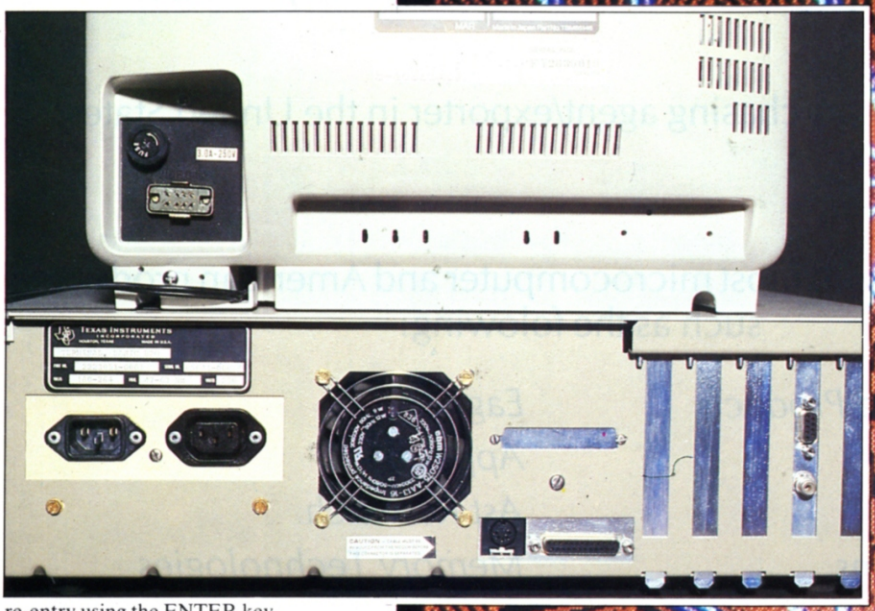
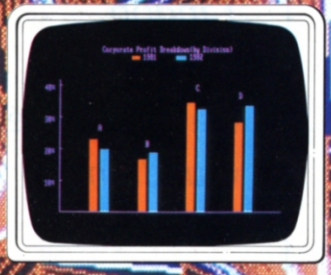
To the rear — on the right are blanked-off slots for interface cables. Video output is the only one present here.





re-entry using the ENTER key.

The function keys INSERT and DELETE may also be used to edit text lines.

The Basic has powerful inbuilt graphic commands. PALETTE allows any of the eight colours to be instantly redefined.

The commands CIRCLE and LINE allow circles, lines and blocks to be drawn by one command. Circle drawing is not as fast as one would expect from an 8088, but pie-charts can be drawn at acceptable speeds.

The commands GET and PUT allow the program to fetch a graphics object from the screen memory and then redisplay it at any other location on the screen.

The command PAINT is used to fill in graphic objects with a particular colour.

Basic allows the keyboard to be redefined using the KEY function and can be used to program the function keys with user information.

MS-DOS, CP/M-86, Concurrent CP/M-86 and UCSD P-system all run on the TI Professional. Hardware options include CP/M-80, additional floppy disk drives and the TI Winchester drive offering up to five megabytes of storage space. A speech input/output card will be available later.

Overview

The TI Professional is a good looking, albeit slightly bulky, desktop machine with impressive colour graphics at a reasonable price. The choice of two of the most popular operating systems means that many software packages will be available for it, and it already has EasyWriter and MultiPlan implemented for MS-DOS.

The documentation for the system and software is well presented and the inclusion of section tabs and clear indexing makes it easy to use.

Overall, I would say this robust machine is well worth the price.

SPECIFICATION

Price:	£2,075
Processor:	8088,5MHz
RAM memory:	64-256K
ROM memory:	8-16K
Text screen:	80 × 25
Graphics screen:	720 × 300
Keyboard:	full travel, 97 keys, 16 function keys
Interfaces:	Centronics, others optional
Storage:	320K double-density, double-sided disks
OS/Language:	MS-DOS and MS-Basic
Others:	Cobol, Fortran, Pascal
Distributor:	TI Ltd 0234 223646
Software supplied:	none (user selected)

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Nigel Cross lends an ear to a Shakespeare-quoting speech synthesiser for the 48K Apple II

Say it again SAM

Despite its dubious acronym — Software Automatic Mouth — and its origins with a Californian company named Don't Ask Computer Software, SAM turns out to be a pleasant kind of character.

In fact, this combined hardware and software package for the 48K Apple II is far better than its trite packaging (awful cartoon character on silver box) and slender instruction booklet indicate.

Setting it up

Once the box is discarded SAM manifests itself as a disk and a small PCB. The board has to be located in slot 4 of the Apple, then two pieces of wire are connected to the internal speaker pin and loudspeaker.

For best results a medium size speaker of four to eight inches is recommended to give an acceptably 'rounded' voice. A volume adjustment is also included so that if you don't like your neighbours you can really give them a hard time.

For more volume you could wire the output to an amplifier — but be careful. The internal speaker is disabled and all sound output is passed through SAM.

Having got this far the disk can be loaded and the demo programs run. These programs include a short story about SAM and its capabilities. Another program is a small selection of famous speeches — Hamlet's soliloquy was definitely interesting but SAM is certainly no Olivier.

The other two should be avoided if only for the content — Allegiance to the Flag and Gettysburg Address.

Up and Running

By this time most people would be falling about in fits of laughter, but don't let this put you off. The real part of the package is very good and easy to use.

To make things easy a subroutine 'reciter' is included so that by encoding an alphanumeric string and performing a call, Reciter decodes English into phonetics, then SAM utters them through the speaker.

This method is very fast and its efficiency is something to marvel at. The English is decoded according to about 450 rules of English pronunciation and copes very well with all sorts of combinations of letters — even absolute gibberish.

An interesting note on this function is that 'goodnight' is pronounced correctly whereas 'goodnite' becomes 'goodnit'.

This use of SAM is obviously limited by the nature of direct translation and does not incorporate much capability for stress, inflection and intonation — not to mention dialect.

However, strings of invective and expletives are wonderfully effective and, in fact, woke up someone in the next room.

Having decided to pass on to SAM itself, the booklet comes into its own. Data passed to SAM can be structured according to the dictionary and by the simple expedient of encoding a phonetic string then issuing a call.

SAM uses about 60 phonetic units, which are noted on a quick reference card, to produce its sounds.

By analysing the words, phrases and sense of what you wish your computer to say using the phonetic reference chart and the dictionary, comprehensive structures can be compounded.

A word of warning — SAM has a 'breath' capacity of only 2.5 seconds, so be sure to encode a pause within the time limit. Unexpected pauses ruin the overall effect.

Once the data has been encoded phonetically it is then possible to add emphasis on a scale of 0 to 9 to every part by including a digit of appropriate value at correct places in the data.

The phonetic writing of compound statements is not easy to start with, but after a little practice it almost becomes second nature (depending on your own accent) and the results turn out to be very pleasing.

As regards the 'voice' of SAM, the first impressions are very reminiscent of a tired and emotional Mexican speaking with his mouth full of chilli, but a bit of effort and thought makes it clearer.

Verdict

This package is very impressive with great scope available to the user for personalisation of program prompts or actual enunciation of data.

The 'voice' becomes clearer with use, but even using just the Reciter function all speech is understandable.

Within its capabilities this is one of the best-implemented speech synthesisers available.

Name: SAM (Software Automatic Mouth)
Machine: Apple II 48K
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The 4510 dot matrix printer allows you to keep your options open, says Andrew Tollyfield.

An impressive list of features from Facit

As the microcomputer market expands, companies which formerly made peripherals for larger computers are being forced to come 'down-market'.

The Swedish-made Facit 4510 printer is a mid-range, high quality dot matrix printer. It is not cheap, but it offers a lot for the price.

The advertising literature for the Facit 4510 claims all the 'extras' come as standard. This is only a slight exaggeration.

The only feature lacking appears to be a software-definable character set, and the only disappointment is that it comes with no connecting lead. But since several different leads would be needed to cover the range of requirements, this is understandable.

Various leads are available at about £15 each.

The Facit is versatile, and has both parallel and serial interfaces, standard and high resolution text printing with proportional spacing if required, and block or high-resolution graphics.

This versatility and good print quality make the 4510 an attractive proposition, even at £498.

With typefaces created under software control, this is just a small selection of the output available from the Facit. This printout shows extended, normal and condensed sans serif, and normal and extended serif faces, and block graphics.

Setting it up

Beneath the printer's adequate packaging is a reasonably compact machine with a smart two-tone plastic cover on a rigid metal base.

Most of the components, including the small DIP setting switches and interface connectors, which protrude at the rear, are on a single horizontal printed-circuit board mounted on the baseplate. The whole construction is fairly sturdy and weighs 5.5kg. The dimensions are 17×13×4.5 in. There is good access to the print-head and large ribbon cartridge, and paper-loading is easy for either friction or tractor feed. Both options can be adjusted to take paper widths from 4in to 11in. An unusual and welcome feature is the inclusion of a paper-roll holder.

The documentation is exhaustive, but clearly aimed at the experienced user — explanations are too terse and occasionally confusing. The detail given is greater than average but a more logical presentation of sections would have helped.

Facilities

The printer has two LEDs, one of which indicates power-on, and the other on-line error. The latter flashes when an error occurs, such as displacement of the print-head.

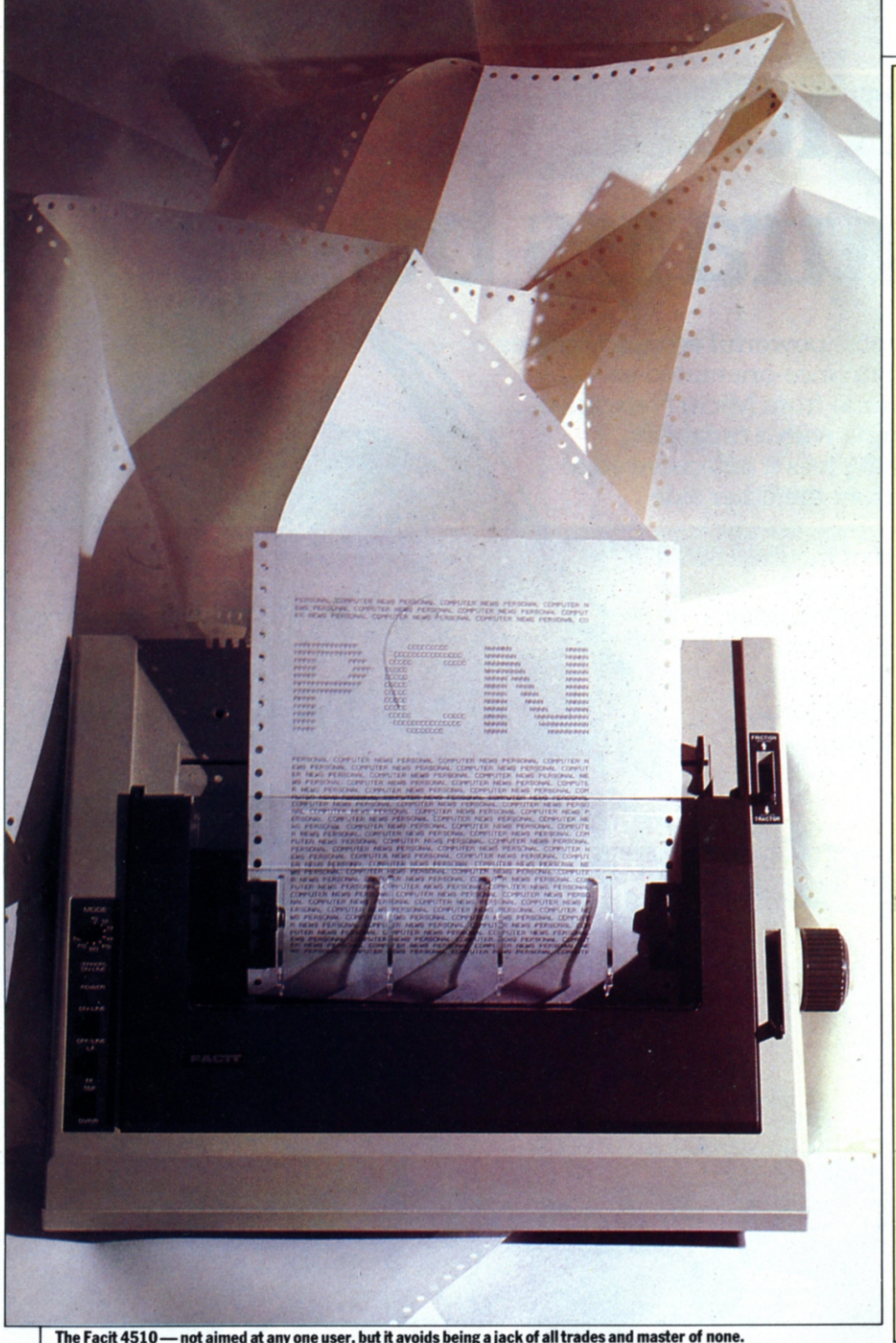
The controls include a mains switch on the left-hand side and suitably recessed, an on/off line switch, line/form switch and a top-of-form/error override switch. The rotary mode switch sets the default printing mode.

By holding the error-override while switching on one can 'self-test' the printer.

The Facit has a 2K buffer, a parallel interface providing both Centronics and Epson protocols, and a serial interface which operates at between 110 and 9600 baud using 7-bit ASCII code.

The now-standard feature of several language sets is available here (including Swedish, Danish, German, Italian, French, Spanish), selectable by switches or software. A programmable ROM containing custom character sets can be inserted on the PCB and one can move between the main or auxiliary character sets under software control.

Any character set can be printed in elongated or underlined mode and the character sizes themselves can be 10, 12 or 17 characters per inch.



The Facit 4510 — not aimed at any one user, but it avoids being a jack of all trades and master of none.

Print for the finish

Picking a printer is an exercise in picking a horse for a course.

There are four printer variables — price, speed, quality and flexibility.

You generally can't get advantages in one area without losing out in others

In striving to mix variables to suit different needs, manufacturers have developed a variety of ways to get words on paper.

Punching a raised metal cast through a ribbon is the most popular way of achieving 'letter quality'. This daisywheel system makes a mess of the other printer variables, especially flexibility and price.

If, like most personal computer users, you are prepared to sacrifice a couple of variables you can get the all-important price down to pocket-size.

At the bottom end of the scale you find the thermal and electrostatic printers which 'singe' characters onto specially coated paper.

These cost less but only at a great sacrifice of all the other variables.

Although rudimentary graphics are possible, speed is bad and quality is offensive (correspondence is not to be entered into).

The matrix printer is a close cousin of the daisywheel but instead of fixed type it uses a row of pins which are programmed to punch dots to form characters or graphics.

Matrix printers are the most popular type and fill a wide range of user requirements from high-quality/expensive to low-quality/cheap.

Block graphics symbols are printed at 7.5, 9 and 12 per inch, while high-resolution graphics have densities of 60, 72 and 100 dots per inch. The latter can also be double printed.

Forward or reverse full- and half-line feeds are useful for subscripts and superscripts, but reverse linefeeds can be used only with friction feed.

The left-hand margin has to be set manually, but the right-hand margin can be set by software. A special space code can be set at any size from 0 to 94.5 dot columns and backspace allows for overprinting a previous character.

This is an impressive list of features.

Facit claims 120 characters per second but linefeed time reduces this to around 80 CPS for full 80-character lines. The noise level is reasonably low and the quality of print is very good, particularly in the high-resolution modes.

The printer uses bi-directional printing in the text and block-graphic modes but automatically reverts to uni-directional printing in the high resolution mode in order to produce the best vertical alignment.

Overview

The 4510 is obtainable from Access Data Communications, Uxbridge, which is the distributor in the country. Service is also available from them on a contract basis but at £100 per year it should be more economical to return the machine for repair.

If faults occur during the six-month warranty period the printer will be replaced.

The Facit's price is high compared with similar printers, but it offers a larger number of options.

In applications where a wide variety of printing requirements exist this printer would be an ideal choice.

Machine: Facit 4510 **Price:** £498 **Speed:** 80 — 120 CPS. **Interfaces:** Centronics/Epson parallel, RS 232 **Contact:** Access Data Communications 0895-59781.

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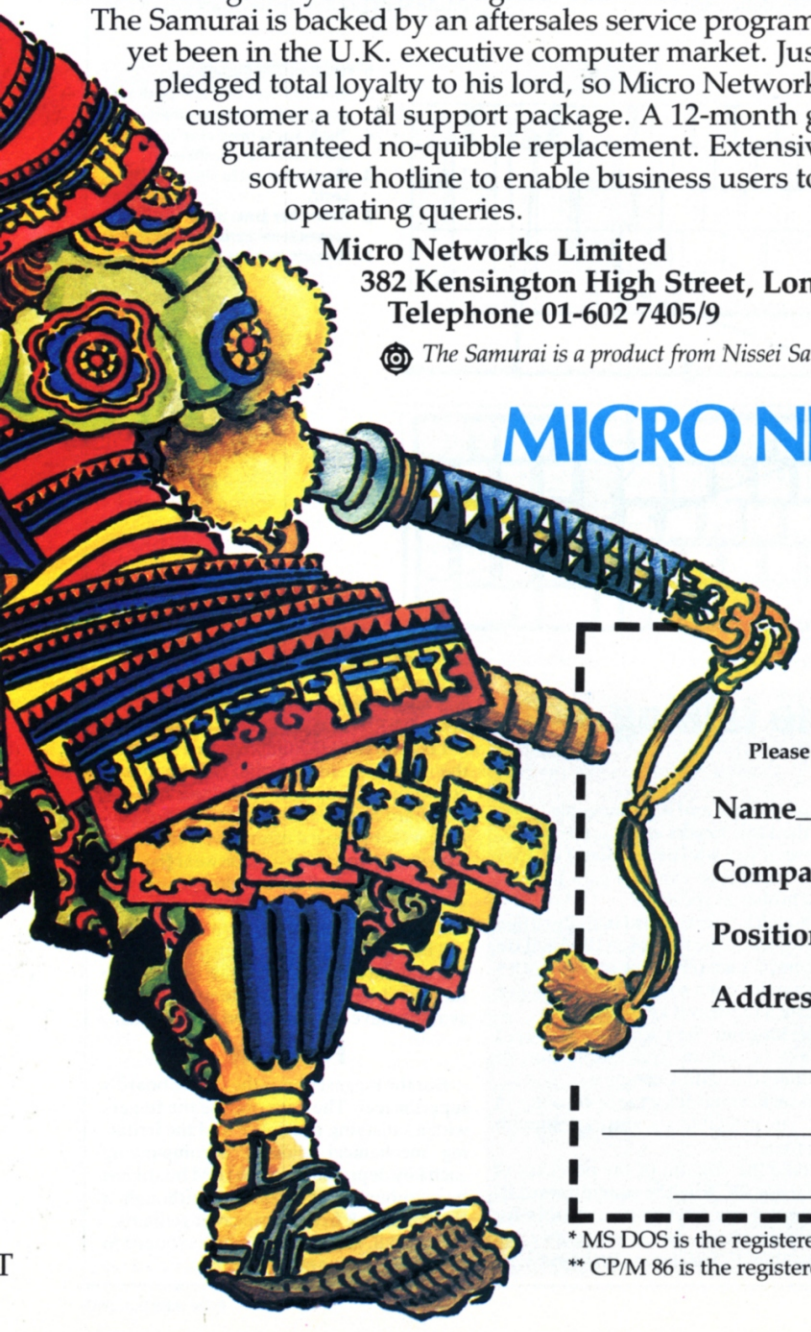

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Ian Scales touches upon a satisfying alternative to the Jolly Giant's fingertip control

Qubie shifts the IBM keys

The first thing a typist notices about the IBM PC is the idiocy of the keyboard.

The problems start with the first word typed. If like most reasonably literate people you start sentences with a capital letter you will more than likely get a '/' appearing on the screen.

This is because the Shift key on the left side is cleverly hidden by the Slash key.

Odd all round

But the keyboard doesn't stop there. It's a rather strange animal all round and has stronger links with IBM's range of typewriters than with the conventional micro. It therefore tends not to endear itself to experienced micro owners.

It's hardly surprising then that other manufacturers have decided to jump in and offer alternatives. IBM customers may be unaware that the company will sell PCs minus the £195 keyboard.

Qubie Distributing is selling a keyboard here in Britain, only weeks after the IBM launch, that attempts to make up some of the IBM's deficiencies.

It's superficially identical to the IBM, sports the same colour scheme and is roughly the same shape and exactly the same size.

All it lacks are those three expensive letters on the casing.

The first and most obvious difference between it and IBM's offering involves switching the Shift and Slash keys. On the Qubie board Shift appears magically under the pinky finger where it should be.

Lighted indicators have also appeared on the Shift Lock and Num Lock keys while the Enter key is horizontal rather than vertical.

Like the IBM the Qubie board meets all the requirements of the ergonomically conscious Europeans who specify low keyboard height and non-glare key-tops.

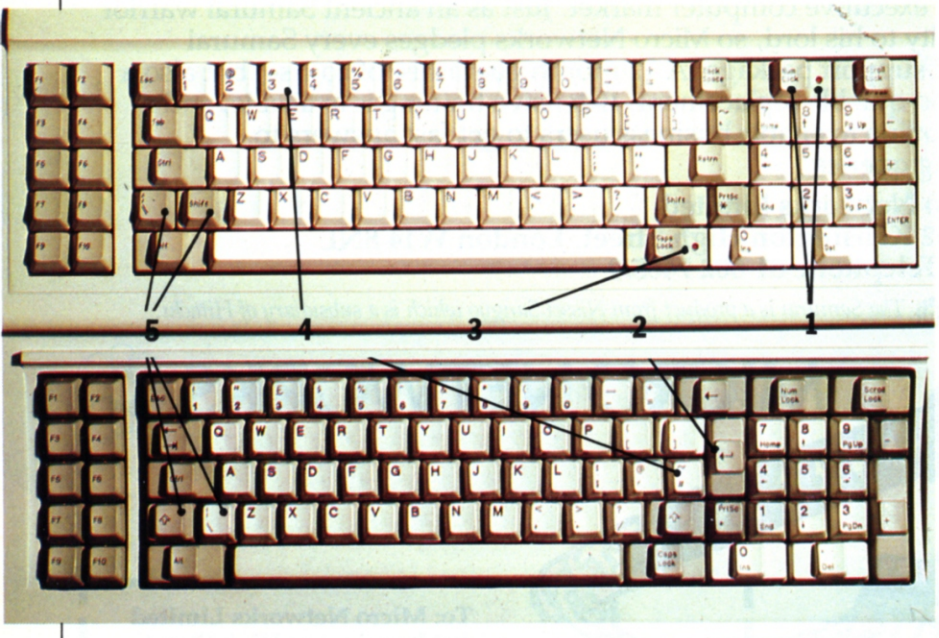
The Qubie board offers a visual illusion with its key-top. You would swear the keys were flatter and wider but close inspection with the help of a ruler shows they are actually about the same.

The hash key has also been moved up to the standard position on the shift of the number 3 key. Some of the more cryptic symbols have been replaced with words.

Feels fine

But the biggest plus is the Qubie board's superior feel. The keys oppose the fingers with a satisfying resistance and the irritating mechanical clicking accompanying each key depression on the IBM board has been thoughtfully banished, although a bearable click from the speaker remains.

All in all, it seems to be the keyboard to successful computing.



IF YOU JOIN THE QUBIES . . .

5. **Awkward caps shift and slash are swopped to avoid mis-strokes.**
4. **'Hash' key is reinstalled in its more customary position.**
3. **Illuminated dot to indicate 'Caps Lock'.**
2. **Return key given more conventional horizontal setting.**
1. **Numeric lock has illuminated dot.**

Model IBM PC Word Processing Keyboard. **Price** £195 ex VAT
Contact Qubie Distributing, 01-870 8899.

Let your fingers do the talking — without interruption

One of the most important features of a micro (or any computer, for that matter) is its keyboard.

To use the industry vernacular, a keyboard is a crucial part of the 'human/machine interface'. It, together with the monitor, provides us with a way of getting information to and fro.

It's rather contradictory, therefore, that the weakest feature of many of the lower-priced micros (especially the ZX81 and Spectrum) is a keyboard which has been the victim of cost-cutting.

To be fair, it would be impossible to get computers this cheap if they had costly full-travel keyboards, but it may be worth it for many users to attach a keyboard as an extra.

As a touch typist, of course, I find myself rather biased about fiddly little keyboards — the space and shift keys are never where you expect them and it's impossible to use more than two fingers at the same time.

Those of you who never intend to learn how to touch-type can also gain benefits from a proper keyboard.

Although it is just as hard initially to find your way round the keys of an IBM as it is a Spectrum, it's amazing how quickly with a bit of practice even a two-finger typist can negotiate a full-travel keyboard.

In the long run, then, a proper keyboard can take a lot of frustration out of communicating with a computer.

Add-on keyboards for the Spectrum and ZX81 are available — usually through mail-order.

To take the risk out of the purchase of one of these, PCN will be running a special round-up of the keyboards available for budding speedsters. In a few weeks we will put together a special mass Pro-Test.

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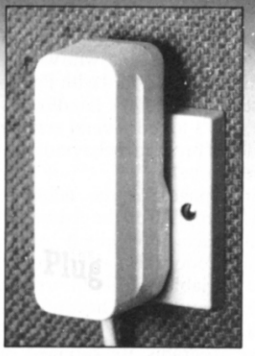

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Warp Factor Ten on the Pet

Compilers promise to make your micro much faster. Barry Biddles hits the accelerator and takes Petspeed for a run.

Name: Petspeed. **Application:** Basic compiler. **System:** Pet 3032. **Price:** £125 ex VAT. **Publisher:** Oxford Computer Systems (Software), 0993-812700. **Format:** Disk. **Other versions:** Commodore 64, 4000, 8000 series. 500 and 700 series soon. **Outlets:** Oxford Computer Systems and most Commodore dealers.

Petspeed is a Basic compiler designed to offer a huge increase in program running speed over interpreted Basic plus a range of extra facilities.

It also claims to be the first optimising Basic compiler to be released for any micro.

Other compilers have to be instructed how to compile your program, but an optimising compiler decides for itself how best to do it. You set up a bank of 'compiler directives', and it does the rest.

Petspeed comes from Oxford Computer Systems, in versions for the Commodore 64, 4000 or 8000 series. I tested it on a 3032 with Basic 4 and a 2040 disk drive. Since I have also spent some time using PC-Basic — another compiler of comparable price and power — I could compare them.

Features

There are four major programs in Petspeed. These run automatically one after the other. They operate on your chosen source program, held on a work disk in the other drive, and convert it to 'speedcode'. This is a low level code designed to be fast and efficient, and is interpreted at RUN time by a special interpreter stored with the final program code.

Petspeed sets out to be compatible with ordinary Pet Basic, but offers a number of facilities not available in interpreted Basic. The most useful of these is the ability to use variable names of any length. Of course, a program you wrote using this option could not be tested before you compiled it. Integer FOR loops may also be used, as well as user-defined strings.

Certain of the normal Pet Basic facilities — such as the LIST command, program overlaying, and dynamic arrays — cannot be used with Petspeed.

Presentation

Petspeed comes with two manuals — one is from Oxford Computer Systems, and the other, more complete one from Commodore. Both use good quality paper with glossy coloured covers, and are bound so that they open flat. The Commodore manual is printed on one side of the paper only, leaving room for your own notes.

The sections on compilation are clear enough for most users, who will be familiar with the Pet itself, and with Pet Basic. But the section on error handling is incomplete, and I found several error messages or kinds of program behaviour not covered by the manual.

Three pages of the manual and an analysis program on the disk are given over to interfacing compiled programs to machine code, and machine code access to Basic variables. The information here seems adequate, but I have not tested these facilities in depth.

The programs are supplied on a disk emblazoned with the distinctive red and black Petspeed logo. You can make a backup copy, since the company uses a dongle plugged into the first cassette port to secure the system. They call the dongle a 'podule' in one manual, and a 'key' in the other.

The dongle isn't required to run your programs once compiled, nor are there any licence restrictions on your use of those compiled programs. This is a welcome contrast to PC-Basic, where the security ROM contains RUN-time code, and you must have permission — not to mention extra ROMs — in order to sell programs compiled by it.

I could find no mention in the manual of any scheme for helping users in trouble, although a telephone number is included in the address.

Getting started

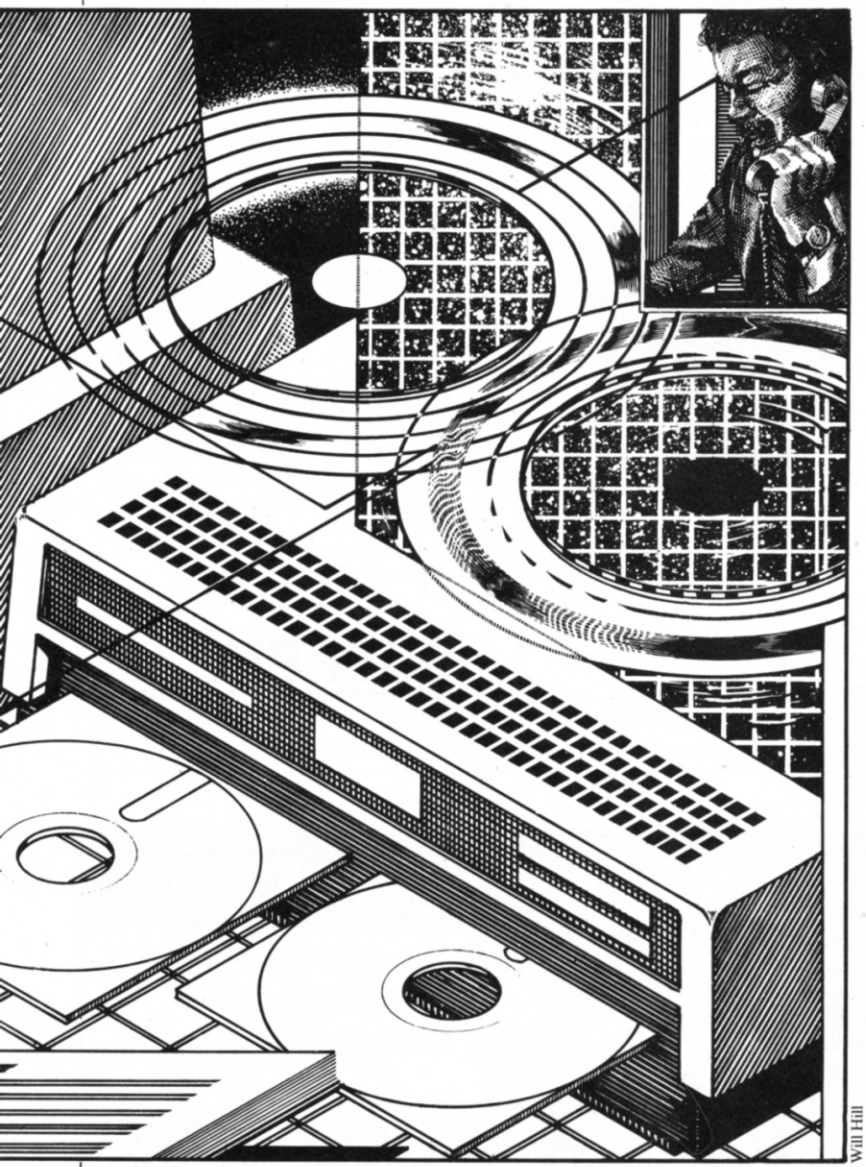
To run Petspeed, you plug the dongle into the cassette port and put the Petspeed disk into drive 0. The program to be compiled goes into drive 1, and needs a disk with about 500 blocks free for a large program. A few seconds after being loaded, Petspeed asks for the name of the source program.

Once you've given the system your program name, you might as well go away and make a cup of tea, as the compile time is at least one minute. In fact, one program of 52 blocks I tried took nearly eight minutes, where PC-Basic needed only three. But as PC-Basic is much more difficult to use, this advantage becomes virtually irrelevant.

Assuming you don't like tea, or you're not thirsty, you can stay and watch Petspeed working its four passes through the code, listing line numbers as it goes. You will then be on the spot to receive the error message if Petspeed is unable to complete the compilation.

At the end of compilation, the compiled code is written back to disk under the original name but with '.gt' appended. It also remains in the Pet ready for immediate execution.

It really is that easy to use, because if you follow the rules and give it only 'clean



Will Hill

Basic' programs to compile, there are unlikely to be any problems. It's worth making a few simple checks as a matter of course, especially if you have any utilities such as BASMON or TOOLKIT, but generally, if it runs under interpreted Basic, it is quite likely to compile.

The further you go from 'clean Basic', the more likelihood there is of problems. Programs which POKE machine code into safe areas of memory may be OK, but the machine code must not access Basic variables — Petspeed stores variables differently.

The manual gives a good deal of helpful information about these restrictions, and you also get a program which lists the addresses of Petspeed variables in the final compilation.

Error handling

I tested Petspeed by compiling as many suitable programs as possible, and by writing a set of benchmarks to answer particular questions. Where I could, I also compared the results by compiling the same programs with PC-Basic.

Within the first two hours, I ran into a number of error messages and situations which were not mentioned in the manual. The first program to fail resulted in the message STRING TOO LONG ERROR. That turned out to be due to a shortage of space on the disk, as Petspeed needs more space during compilation than appears afterwards.

A chemist friend's program, written with lots of spacing lines, and tables of atomic weights and elements neatly laid out one per DATA line, also ran into trouble. Here, the message TOO MANY LINES (>1020) ERROR came up — this error is not listed, but it is self-explanatory, and easily cured. The same friend ran into another unlisted error message, equally easily cured, by using a variable which is unreserved with Basic 2, but reserved under Basic 4.

Compilation can also fail due to lines which are perfectly acceptable — though incorrect — under interpreted Basic. For example, a program can contain two conflicting DIM statements, only one of which is ever encountered in one RUN. But as the compiler sets both up during compilation, it will fail.

Two programs also failed with a syntax error message, where there was in fact no such error in or around the line in question.

Performance

The manual claims speeds up to 40 times faster than interpreted Basic. I assume that figure must apply to individual statements, as these get the maximum benefit from being compiled. With complete programs, I found the average speed increase was more like ten to 15 times.

An empty FOR-NEXT loop ran five times faster (PC-Basic gave a ninefold improvement), while a loop containing Y=TAN(X) was little faster than the empty loop with either compiler. A screen flasher benchmark ran about ten times faster (18 times with PC-Basic), and Labyrinth, a program heavy on graphics and string manipulation, also ran about ten times faster — PC-Basic gave a figure of 16 times. A database program, in which the data was stored in DATA statements, gave 15 times faster access — PC-Basic was unable to compile this one.

Reliability

The majority of Basic programs will compile correctly, with very few modifications. Petspeed has occasionally failed, giving error messages which were apparently wrong, but I have yet to get any run-time errors with programs which were successfully compiled.

Verdict

Petspeed is particularly easy to use, and gives a great improvement to the running speed of Basic programs. It does have drawbacks, in that it is slower in operation than its rival, PC-Basic, and needs a lot of disk space to compile.

PC-Basic, on the other hand, is fast in operation and its compiled programs run faster. It offers extra facilities, but is harder to use than Petspeed. I feel that PC-Basic would be best for programs written with the compiler in mind, but Petspeed has the advantage of being equally suitable for compiling programs not written by the user. Hence I would rate PC-Basic more highly on features and documentation, but on performance, reliability and ease of use, Petspeed is the clear winner.

RATING

Features — ▮▮▮
Presentation — ▮▮▮
Performance — ▮▮▮▮
User interface — ▮▮▮▮
Reliability — ▮▮▮
Overall value — ▮▮▮▮

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BARCLAYCARD VISA

Rod McKendrick gets to grips with a series of programming utilities that build into a single toolbox

Open the box and tune up your Sirius

Toolbox provides Sirius programmers with the sort of utilities CP/M-86 should offer, but doesn't. It is a development package of some 35 modules, and is designed to help CP/M programmers get the most out of the 16-bit micro.

It covers disk management, data management, and program development. And if you want to migrate up to CP/M-86 from CP/M-80 systems, you look in Toolbox.

Features

Toolbox comes either as a complete set, or as five individual modules — the Base Module, ScreenPlot, Screenwright/Keybase, TRX, and Sourcerer.

ScreenPlot is a screen graphics handler. It provides a skeleton Basic program, with pre-coded calling sequences which support a number of primitive graphics functions.

Screenwright/Keybase consists of a screen format generator and a keyed random access file handling system. The Screenwright section allows you to design, create edit, input and display screens at the terminal. Keybase is made up of four programs, which will define the file's physical attributes, initialise disk space, READ and WRITE to the file, and call the READ and WRITE routines.

TRX transfers files between two linked, CP/M micros, while Sourcerer disassembles 8080, 8086 and Z80 command files, and will also take 8080 and Z80 object files and generate 8086 source code.

Presentation

If you buy it as a complete set, Toolbox comes in a free 'Programmer's Document Case'. The review set came with two disks holding the utilities, and two further demonstration disks, all clearly marked.

The documentation includes a product release notice and a user manual, as well as instructions on the use of the demonstration disks. A brief introduction gives an overview of each utility, then a more detailed section on each module.

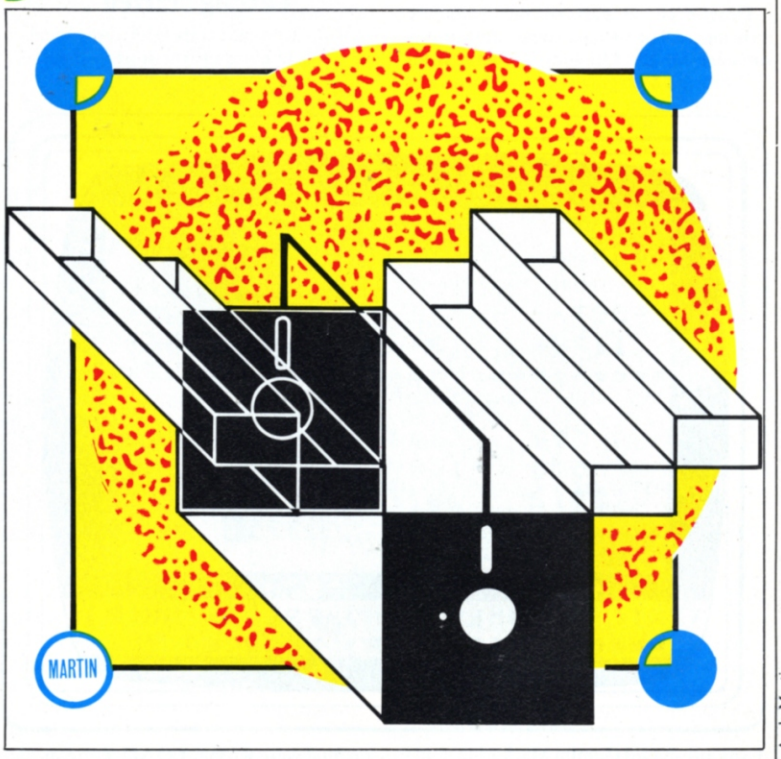
In Use

Experienced programmers should find most of the Base Module utilities easy to use, learn and install but Screenplot is a little more difficult and it took about half an hour of trial and error to get under way. I suspect that this one was written by the same person who wrote the software.

Two of the conversion utilities transform 8080 and Z80 assembler source code into 8086 assembler, while a third performs the first step in converting CBASIC into Microsoft Basic. GETFILE, the file transfer utility, copies files from MS-DOS disks to CP/M-86 disks.

One of the Base Module's best features is DIRECTORY EXTENDER, which labels all your disks and records your files.

SECEDIT can examine and edit sectors of a disk, while FILEDIT lets you edit the logical sectors of a file. DUMP gives you both a hex and an ASCII file dump, and another pair of utilities compare two files byte by byte, or record by record, and report any differences back to you.



Andy Martin

PROFILE monitors the input-output activity of another program, and SNAP can be called by a Basic program to copy the screen contents to a disk file or printer. FILM copies all screen output to a disk file, which you can then examine by editing it or by using REPLAY.

Reliability

None of the modules I tested crashed. Even if they occasionally had, I would not regard that as such a major problem, since they are programmer aids. The one real exception, which I would hate to have to crash, would be the Directory Extender utility, and for that there are no documented recovery procedures.

Verdict

This is certainly an above average package. The only real fault lies with the user manual — in the ScreenPlot section, especially, I would have welcomed examples of the use of graphics primitives. The Screenwright/Keybase module seems to me extremely good value for money, with features that compare favourably with the Microfocus Forms-2 package.

Depending on how much additional application coding is needed, you could use Screenwright and Keybase to save an immense amount of time writing screen handling and field validation code.

RATING

Features —
Presentation —
Performance —
User interface —
Reliability —
Overall —

NAME Toolbox **APPLICATION** program development tools **SYSTEM** Sirius I CP/M-86 **PRICE** £575 or £286 base module, £171 other modules **PUBLISHER** Export Software International, 031-556 3266 **FORMAT** disk **LANGUAGE** Basic and Assembler **OTHER VERSIONS** MS-DOS, PC-DOS due shortly **OUTLETS** mail order, most IBM and Sirius/Victor dealers.

You can count on Dragoncalc from Gemini, but you can't rely on it, as Pete Galliard discovered

Better with a pencil

Some programs save you such a vast amount of time and effort that they pay for themselves within days of purchase.

Others do not, and unfortunately, Dragoncalc is one of the latter. In fact, it's one of those spreadsheet packages that makes you feel inclined to invest in a sheet of paper and a pencil. They tend to be easier to use and a good deal more reliable.

Dragoncalc is part of the gradually growing pool of business-type applications software for the Dragon. It comes from Exmouth-based Gemini Marketing, and is a simple spreadsheet. It isn't really designed for sophisticated accounts or budgeting.

Features

This package is very simple indeed. The spreadsheet is divided into cells, with each cell being assigned a row and column number, up to a limit of 26 rows and 20 columns. A number or piece of text can be placed into each seven-character wide cell, and you view parts of the sheet through a movable window four columns wide by 12 rows high. Numbers may have a precision of up to six decimal places.

Any formula you set up to calculate the contents of some cells from the contents of others may be repeated in a block of cells of your choice, and you can also repeat data you enter in the same way. You can inspect formulae, you can save tables you have created onto tape, and you can recalculate the spreadsheet.

None of the more sophisticated operations, such as combining different spreadsheets, inserting or deleting rows or columns, or allocating projected cells, can be performed.

Presentation

Dragoncalc comes on a cassette together with a demonstration budget table on Side 2. There is also a very brief six-page pamphlet which serves as the user manual.

Getting started

I got off to a bad start with Dragoncalc, since the loading instructions in the user manual were wrong. LOAD 'Dragoncalc' should in fact be CLOAD 'Calc'

In use

According to the user manual, you can enter up to 26 rows and 20 columns. I tried doing so, but found that I ran out of memory long before I reached those absolute limits.

No warning is given as you approach the end of memory, and as soon as I overstepped the limit, the system crashed. To recover, you must restart, and the whole file is lost.

I had more success with smaller models, but I found myself hampered by a number of restrictions. There are just 13 commands at your disposal, and numbers have a limit of seven digits.

Calculation is done by the EVALUATE command — but it is not possible to calculate small parts of the model at a time. Instead, you have to recalculate the entire model every time you want to calculate a formula which may apply only to a couple of cells.

The BLANK command is also inflexible — you can either BLANK out the whole model, or just one cell at a time — there are no in-between options. The REPEAT command also has its drawbacks. It can be used to duplicate data and replicate formulae, but when I tested it, it caused the model to run out of space, and the system crashed.

Performance

The one thing this package has in its favour is its relatively good speed of operation. The window can be moved about the sheet quite quickly, although recalculation of a test model of 18 rows and 13 columns — about the maximum model size I was able to create — took nearly four minutes.

But, it was still a slow package to use because the EVALUATE command insists on recalculating the entire sheet.

Reliability

The package is unreliable. The system crashed when I exceeded the memory limit or used REPEAT too enthusiastically.

I was given the option of getting back into the program with BREAK and GOTO 1000, but even after I had done so, and even if I tried erasing formulae, each time I came to re-evaluate, it crashed again. I had to abandon the whole model.

It also ran into trouble when I accidentally pressed the L key. Assuming that a file was to be LOADed, the program sat and waited for me to put on a cassette. There was nothing to do but lose the whole model.

Gemini told me that it had received some complaints and that the problems are being looked into.

Verdict

Dragoncalc has such serious problems with reliability and flexibility that I would prefer to stick to pencil-and-paper calculations. By comparison, Microl's £9.95 Spreadsheet for the Sinclair Spectrum, reviewed last week, is streets ahead.

Asked to comment on the problems found in Dragoncalc, Dale Hubbard, managing director of Gemini Marketing, said PCN had been sent a development copy of the program in error. He promised to send a proper review copy.

RATING

Features —
Presentation —
Performance —
User interface —
Reliability —
Overall value —

Name Dragoncalc **Application** Spreadsheet **System** Dragon 32 **Price** £19.95 **Publisher** Gemini Marketing, 03952-5832 **Format** Cassette **Language** Basic **Other versions** none **Outlets** Mail order, various dealers.

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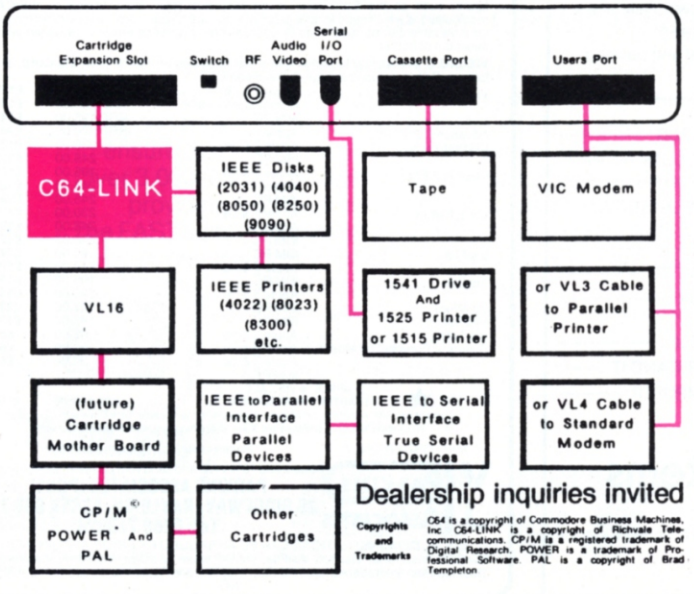

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As well as complete programs, a subroutine with an example of its use will be printed each week from the PCN library.

This week

Chris Davison, a reader from Newton Abbott, Devon, sent in his Spectrum utility to magnify characters on screen.

This helps in the designing of user-defined graphics and shows the sensible use of the POINT command.

Joe Thompson, of Chester-le-Street, County Durham, has supplied his easy-to-use Vic-20 game Spider which includes a nice routine to change the colours of individual characters on the instructions page by varying the screen attributes.

Another game, Firing Range, for the BBC Model B, comes from a Mrs M Thatcher (no relation), of Coventry, who unfortunately suffers a hearing impediment. The game, therefore, contains no sound functions. However, these can easily be added by the use of PROCEDURES at appropriate points. The graphics techniques can be used as a basis for many other games or programs.

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PCN ProgramCards

Magnify Utility Card 1 of 1

8303MU

A useful, small utility program incorporating a subroutine to magnify characters as entered.

```
10 REM A program to demonstrate the magnification of characters
20 PAPER 0
30 INK 6
40 BORDER 2
60 CLS
70 INPUT "Enter string to be magnified (1 - 4 characters)"; A$
80 IF A$ = "" THEN PRINT AT 0,0; "PROGRAM ENDED": STOP
90 REM If no characters entered then program ends
100 PRINT AT 0,0; A$
110 GO SUB 1000
120 GO TO 70
1000 REM Subroutine to explode input as printed at 0,0
1010 FOR A = 0 TO 31

1020 FOR B = 175 TO 167 STEP -1
1030 IF POINT(A,B) = 1 THEN PRINT AT 178 - B,A; "■"
1040 NEXT B
1050 NEXT A
1060 RETURN
```

Sinclair Spectrum
Sinclair Basic

Requirements: 16K
Application: utility

20 Set screen colour attributes

60 Clear screen
70 Obvious
80 End program if no data entered

100 Display entry at screen home
110 Execute magnification
120 Repeat
1000 Subroutine MAGNIFY
1010 Step horizontally across displayed characters
1020 Step vertically through character
1030 Print "■" for each active pixel
1040 Vertical loop end
1050 Horizontal loop end
1060 Routine returns to mainline program

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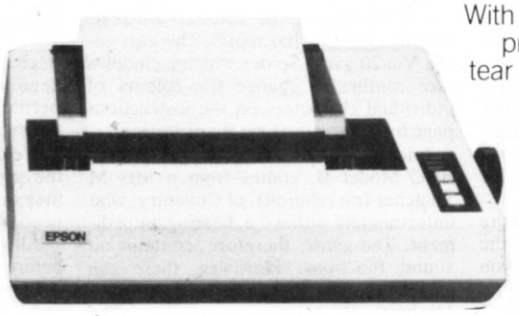

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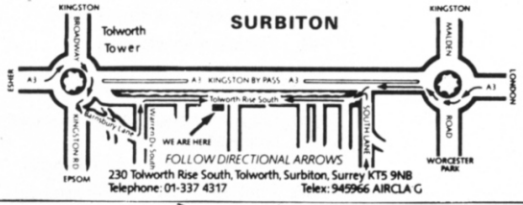

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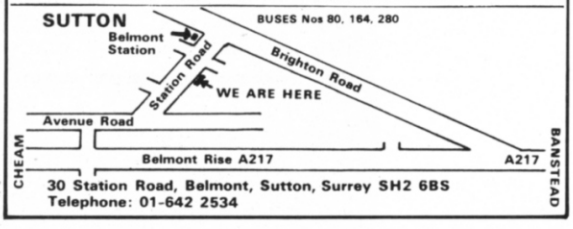

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PCN Programcards

Spider — Card 1 of 2

8303S1/2

Here's a short arcade game for the Vic. Instructions are in the program

```
>
>LIST
    1 REM ** SPIDER **
    2 REM
    3 REM FOR UNEXPANDED
    4 REM VIC 20
    5 REM
   10 GOTO 1010
   15 REM ** UPDATE SCORE **
   20 PRINT "[HOME]HS "; TAB(8-LEN(STR$(HS))); HS; "   SC "; TAB(22-LEN(STR$(SC)
));:
   25 RETURN
   30 REM ** MOVE MAN **
   40 GET K$
   50 IF K$ = "I" THEN D = 1
   52 IF K$ = "J" THEN D = 7
   54 IF K$ = "K" THEN D = 3
   56 IF K$ = "M" THEN D = 5
   60 X = X+XD(D): Y = Y+YD(D): IF X<0 OR X>LL-1 OR Y<1 OR Y>LD OR PEEK(TL+Y*LL+
X) = PL THEN 710
   70 POKE TL+Y*LL+X,PL: POKE AT+Y*LL+X,RED
   80 IF X<>SX OR Y<>SY THEN 90
   82 FOR I = 1 TO 5: SC = SC+1: GOSUB 20: FOR J = 230 TO 250
   84 POKE VL,15: POKE S1,J: NEXT J: NEXT I: POKE V,0: POKE S1,0
   86 SX = FNR(LL): SY = FNR(LD): IF PEEK(AT+SY*LL+SX) = RED THEN 86
   87 POKE TL+SY*LL+SX,SP: POKE AT+SY*LL+SX,GREEN
   90 REM ** MOVE SPIDER **
  100 DS = SQR((X-SX)^2+(Y-SY)^2)/15: M = ABS(RND(1)>DS)+ABS(RND(1)>DS)
  110 NX = SX+M*SGN(SX-X): NY = SY+M*SGN(SY-Y)
  113 IF M = 0 THEN 40
  115 IF NX>1 AND NX<LL-1 AND NY>2 AND NY<LD-1 AND PEEK(AT+NY*LL+NX) <> RED THEN
 130
  120 NX = SX-XD(FNR(8)): NY = SY-YD(FNR(8)): M = M-1: GOTO 113
  130 POKE AT+SY*LL+SX,1: SX = NX: SY = NY: POKE TL+SY*LL+SX,SP: POKE AT+SY*LL+S
X,GREEN
  140 GOTO 40
```

Vic 20
Vic Basic

Requires: Unexpanded Vic
Application: game

Refer to Vic 20 Programmer's reference guide for PEEK and POKE use. Special characters are printed in square brackets with the name of the character and the number of characters to be typed. For example, [6CD] means type six cursor down characters.

10 go to the INIT section

20 subroutine to update score line

40 move player's line

60 go to 710 if player leaves screen or hits line

80 hit spider so make noise, update score and replace spider

100 move spider if necessary. Uses Pythagoras's theorem to calculate the distance between the player and spider. Normally the spider moves away from the player (using SGN function) but if it can't, it will move randomly

140 loops to 40 to continue the main game loop

PCN Programcards

Spider — Card 2 of 2

8303S2/2

```
  700 REM ** END GAME **
  710 POKE VL,15: POKE S1,230: FOR I = 1 TO 200: NEXT I: POKE S1,240: FOR I = 1
TO 400: NEXT I
  720 POKE S1,245: FOR I = 1 TO 500: NEXT I: POKE S1,0
  730 PRINT "[HOME][6CR][8CD]SCORE "; SC
  740 IF SC>HS THEN FOR I = 128 TO 255 STEP 3: POKE VL,15: POKE S1,I: FOR J = 1
TO I STEP 10: NEXT J: NEXT I
  750 IF SC>HS THEN HS = SC: PRINT "[CD][4CR]NEW HIGH SCORE"
  760 POKE S1,0: FOR I = 1 TO 1000: NEXT I

  800 REM ** TITLE PAGE **
  810 PRINT "[CLS]": GOSUB 20
  815 PRINT: PRINT: PRINT "    [3SHIFT-Q] SPIDER [3SHIFT-Q]"
  820 PRINT: PRINT "SWOT AS MANY BLOBS AS YOU CAN BEFORE YOU HIT YOUR OWN LINE O
R GO"
  830 PRINT "OFF THE SCREEN": PRINT: PRINT "USE J LEFT K RIGHT        I UP   M D
OWN"
  840 PRINT: PRINT "GOOD LUCK ..."
  850 PRINT: PRINT "PRESS P PLAY OR S STOP"
  870 I = AT
  875 GET A$: IF A$ = "S" THEN PRINT "[CLS]": END
  877 IF A$ = "P" THEN 910
  890 POKE I,FNR(6)+1
  895 I = I+1: IF I < 38750 THEN 875
  897 GOTO 870
  900 REM ** NEW GAME **
  910 SC = 0
  915 PRINT "[CLS]": GOSUB 20
  920 X = 10: Y = 10: D = 1: SX = FNR(LL): SY = FNR(LD)
  940 POKE TL+LL*Y+X,PL: POKE AT+LL*Y+X,RED: POKE TL+LL*SY+SX,SP: POKE AT+LL*SY+
SX,GREEN
  990 GOTO 40
 1000 REM ** INIT **
 1010 PRINT"[CLS]": POKE 36879,27
 1020 TL = 7680: AT = 38400: LL = 22: LD = 22
 1030 VL = 36878: S1 = 36874: NS = 36877
 1040 PL = 102: SP = 81: RED = 2: GREEN = 5
 1080 DEFFNR(X) = INT(RND(1)*X+1)
 1100 FOR I = 1 TO 8: READ XD(I),YD(I): NEXT I
 1110 DATA 0,-1,1,-1,1,0,1,1,0,1,-1,1,-1,0,-1,-1
 1120 GOTO 810
```

700 End of game
710 fanfare at end of game

740 update high score

760 pause before dropping into title page
800 Present title page/instructions

870-897 loops while waiting for a keypress. Each loop alters the next colour attribute of the screen, making the instructions change colour

900 New game

915 sets initial positions of the player and spider and starts a game

1000 Init section

1010 sets POKE and PEEK addresses and values for playing pieces, colours and so on

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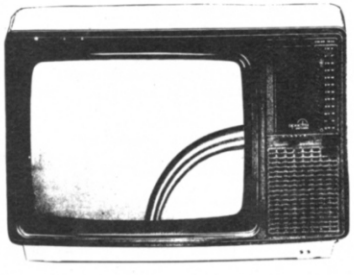

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PCN Programcards

Firing Range Card 1 of 4

8303FR1/4

This is an easy-to-play game written originally to help in understanding graphics; techniques used have since been incorporated in other programs.

```
  10  MODE 1: VDU 19,0,4;0;19,1,5;0;19,3,6;0;
  20  GCOL 0,128: CLS

  30  HI% = 0: TI% = 1000
  40  S% = 16: D% = 1


  50  PROC_INTRO
  60  PROC_PLAY
  70  GOTO 50
1000  DEF PROC_INTRO
1010  COLOUR 2: CLS

1013  VDU 23,1,1;0;0;0;
1015  *FX 12,0

1017  *FX 15,1
1020  PRINT TAB(7,4) "WELCOME TO THE FIRING RANGE"
1030  PRINT TAB(7,8) "DO YOU WANT INSTRUCTIONS - I"
1040  PRINT TAB(7,12) "START THE GAME            - S"
1050  PRINT TAB(7,16) "END THE GAME              - E"
1060  PRINT TAB(7,20) "ENTER APPROPRIATE LETTER   ";
1070  A$ = GET$: PRINT A$
1080  IF A$ = "E" THEN CLS: PRINT TAB(7,16) "GOODBYE. THANK YOU FOR PLAYING": E
ND
1090  IF A$ = "S" THEN GOTO 1245
1100  IF A$ <> "I" THEN GOTO 1060
1110  CLS
1120  PRINT TAB(1,2)"YOU are a special agent using the range"
1130  PRINT TAB(1,4)"Targets appear one at a time"
1140  PRINT TAB(1,6)"YOUR task is to destroy them"
1150  PRINT TAB(1,8)"You start with 12 shots only"
1160  PRINT TAB(1,10)"Bonus shots are given every THREE kills"
1170  PRINT TAB(1,12)"Score 100 for kill 10 for wounding"
1180  PRINT TAB(1,14)"To move sight up    - K"
1190  PRINT TAB(1,16)"               down  - S"
1200  PRINT TAB(1,18)"               left  - A"
1210  PRINT TAB(1,20)"               right - L"
1220  PRINT TAB(1,22)"Fire using SPACE BAR - single shot only"
1230  PRINT TAB(1,24)"Press any key to start"
```

BBC Model B
BBC Basic

Requirements: 32K
Application Game

10 Set four-colour graphics to magenta, cyan, yellow on blue

30 *HI%* — top score. *TI%* — time of target display. *S%* — sight step size. *D%* — flag for drawing sight

50 Main program loop

1000 Introduction/instruction procedure. Write in yellow

1013 Turn on cursor

1015 Set auto repeat and delay to default

1017 Clear keyboard buffer

1070 Single key reply

1090 Bypass instructions

PCN Programcards

Firing Range Card 2 of 4

8303FR2/4

```
1240  A$ = GET$

1245  *FX 11,1
1250  *FX 12,1

1255  VDU 23,1,0;0;0;0;
1260  ENDPROC
1500  DEF PROC_PLAY
1510  SCORE% = 0: SHOTS% = 12: HIT% = 0: CLS
1520  PROC_SCORE_LINE: F% = 0: T% = 0

1530  PROC_TARGET
1540  IF F% = 0 THEN PROC_HOME: PROC_SIGHT: F% = 1
1550  SHOWN = TIME + TI%
1560  REPEAT
1565    *FX 15,1
1570    A$ = INKEY$(0)
1580    IF A$ = "K" THEN PROC_UP
1590    IF A$ = "S" THEN PROC_DOWN
1600    IF A$ = "A" THEN PROC_LEFT
1610    IF A$ = "L" THEN PROC_RIGHT
1620    IF A$ = " " THEN PROC_FIRE
1625    IF SHOTS% = 0 THEN SHOWN = TIME
1630    UNTIL TIME >= SHOWN
1640  IF SHOTS% > 0 THEN GOTO 1530
1650  IF SCORE% > HI% THEN HI% = SCORE%
1660  CLS: PROC_SCORE_LINE
1670  PRINT TAB(1,16)"TO PLAY AGAIN - PRESS Y"
1675  *FX 11,0
1677  *FX 15,1
1680  A$ = GET$
1690  IF A$ = "Y" THEN GOTO 1510
1700  ENDPROC
2000  DEF PROC_SCORE_LINE
2010  PRINT TAB(1,1)"SCORE ";SCORE%
2020  PRINT TAB(12,1)"SHOTS LEFT ";SHOTS%;" "
2030  PRINT TAB(26,1)"TOP SCORE ";HI%
2060  ENDPROC
2200  DEF PROC_HOME
2210  X% = 640: Y% = 32
2230  ENDPROC
2300  DEF PROC_SIGHT
2310  GCOL 4,3
2320  MOVE X%,Y%: DRAW X%,Y%-32: DRAW X%+31,Y%-32: DRAW X%+31,Y%+31: DRAW X%-32
,Y%+31: DRAW X%-32,Y%-32: DRAW X%,Y%-32
2330  ENDPROC
```

1240 Any key starts

1245 Set auto-repeat start delay to 1/100 sec

1250 Set auto-repeat to 1/100 sec

1255 Turn off cursor

1500 Playing procedure

1510 Set start values and show score line. *F%*, *T%* — display flags

1530 Draw target

1540 Sight at base

1550 *Shown* — target time

1560 Keyboard action loop

1565 Clear keyboard buffer

1570 Accept key in zero time

1580 What action?

1625 No shots left — leave loop

1640 Shots left — round again

1650 Update top score

1675 Reset auto-repeat function

1677 Clear keyboard buffer

1680 Single key reply — "Y" = restart game

1700 Return to main program loop

2000 Display score line procedure

2200 Procedure set to base values of sight

2310 Inverted colour — cyan/blue

2320 Sight is drawn/undrawn

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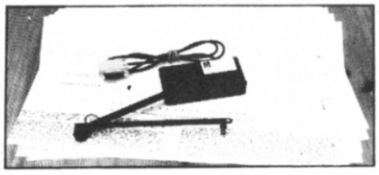

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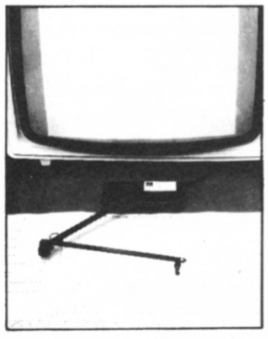

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PCN Programcards

Firing Range Card 3 of 4

8303FR3/4

```
2400  DEF PROC_TARGET
2405  IF D% = 1 THEN PROC_SIGHT
2410  IF T% = 1 THEN PROC_UNDRAW
2420  TX% = INT(RND(288)*4 + 63)
2430  TY% = INT(RND(192)*4 + 63)
2440  PROC_DRAW: IF D% = 1 THEN PROC_SIGHT
2450  ENDPROC
2500  DEF PROC_DRAW
2510  GCOL 0,1: T% = 1

2520  FOR N = 1 TO 128 STEP 4
2530    PROC_BODY
2540    NEXT N
2550  FOR N = 1 TO 64 STEP 4
2560    PROC_HEAD
2570    NEXT N
2580  ENDPROC
2600  DEF PROC_BODY
2610  MOVE TX%-64,TY%-64+N: DRAW TX%+63,TY%-64+N
2620  ENDPROC
2650  DEF PROC_HEAD
2660  MOVE TX%-32,TY%+64+N: DRAW TX%+31,TY%+64+N
2670  ENDPROC
2700  DEF PROC_UNDRAW
2710  GCOL 0,0: T% = 0

2720  FOR N = 64 TO 1 STEP -4
2730    PROC_HEAD
2740    NEXT N
2750  FOR N = 128 TO 1 STEP -4
2760    PROC_BODY
2770    NEXT N
2780  ENDPROC
3000  DEF PROC_UP
3010  PROC_SIGHT
3020  Y% = Y%+S%
3030  IF Y% > 991 THEN Y% = Y%-S%
3040  PROC_SIGHT
3050  ENDPROC
3100  DEF PROC_DOWN
3110  PROC_SIGHT
3120  Y% = Y%-S%
3130  IF Y% < 32 THEN Y% = Y%+S%
3140  PROC_SIGHT
3150  ENDPROC
```

2400 Target selection procedure
2405 Undraw sight if coincident with target
2410 Undraw target if target exists
2420 Select random coordinates for target. MOD 4 for pixel size
2440 Draw target. Draw sight if necessary

2500 Target drawing procedure
2510 Magenta. *T%* = 1 flags target existence
2520 Draw body from bottom to top

2550 Draw head from bottom to top

2600 Draw single body line procedure

2650 Draw single head line procedure

2700 Target undrawing procedure
2710 Blue (background). *T%* = 0 flags no target
2720 Undraw head from top to bottom

2750 Undraw body from top to bottom

3000 Procedure to move sight up (K)
3010 Undraw sight
3020 Move up by *S%*. Limit at top of available screen
3040 Draw sight

3100 Procedure to move sight down (S)
3110 Undraw sight
3120 Move down by *S%*. Limit at bottom of screen
3140 Draw sight

PCN Programcards

Firing Range Card 4 of 4

8303FR4/4

```
3200  DEF PROC_LEFT
3210  PROC_SIGHT
3220  X% = X%-S%
3230  IF X% < 32 THEN X% = X%+S%
3240  PROC_SIGHT
3250  ENDPROC
3300  DEF PROC_RIGHT
3310  PROC_SIGHT
3320  X% = X%+S%
3330  IF X% > 1247 THEN X% = X%-S%
3340  PROC_SIGHT
3350  ENDPROC
3500  DEF PROC_FIRE
3520  SHOTS% = SHOTS%-1: H% = 0

3530  IF ABS(TX%-X%) < 33 AND ABS(TY%-Y%) < 33 SCORE% = SCORE% + 100: HIT% = HI
T% + 1: H% = 1: PROC_DEAD
3540  IF ABS(TX%-X%) < 33 AND ABS(TY%-Y%+63) < 65 THEN SCORE% = SCORE% + 100: H
IT% = HIT% + 1: H% = 1: PROC_DEAD
3550  IF ABS(TX%-X%) < 65 AND ABS(TY%-Y%) < 65 THEN SCORE% = SCORE% + 10: PROC_
DEAD
3560  IF H% = 1 AND HIT% - INT(HIT%/3)*3 = 0 THEN SHOTS% = SHOTS% + 1
3565  IF H% = 1 AND HIT% - INT(HIT%/6)*6 = 0 THEN SHOTS% = SHOTS% + 1
3570  IF H% = 1 AND HIT% - INT(HIT%/12)*12 = 0 THEN SHOTS% = SHOTS% + 1
3580  PROC_SCORE_LINE
3590  H% = 0
3600  ENDPROC
4000  DEF PROC_DEAD
4020  FOR N = 0 TO 7
4030    PS% = TIME + 10
4040    REPEAT: UNTIL TIME >= PS%
4050    VDU 19,1,N;0;
4060    NEXT N
4065  VDU 19,1,5;0;
4070  PROC_SIGHT
4075  D% = 0
4080  PROC_TARGET
4085  D% = 1
4090  PROC_HOME
4095  PROC_SIGHT
4100  SHOWN = TIME + TI%
4110  ENDPROC
```

3200 Procedure to move sight left (A)
3210 Undraw sight
3220 Move left by *S%*. Limit at side of screen

3240 Draw sight

3300 Procedure to move sight right (L)
3310 Undraw sight
3320 Move right by *S%*. Limit at side of screen
3340 Draw sight

3500 Procedure invoked on fire (space bar)
3520 Reduce shots by 1. Set kill flag *H%* to zero
3530 Centre of body kill

3540 Head kill

3550 Body wound

3560 If killed add 1 shot for multiples of 3, 6, 12 kills

3580 Display new scores

4000 Procedure used when hit occurs
4020 Flash target. 1/10 second per colour

4065 Change colour back to magenta
4070 Undraw sight
4075 *D%* is target flag
4080 Remove target and produce new one
4085 *D%* is target flag
4090 Set base values for sight
4095 Draw sight
4100 Clear time loop

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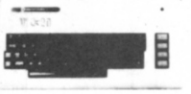

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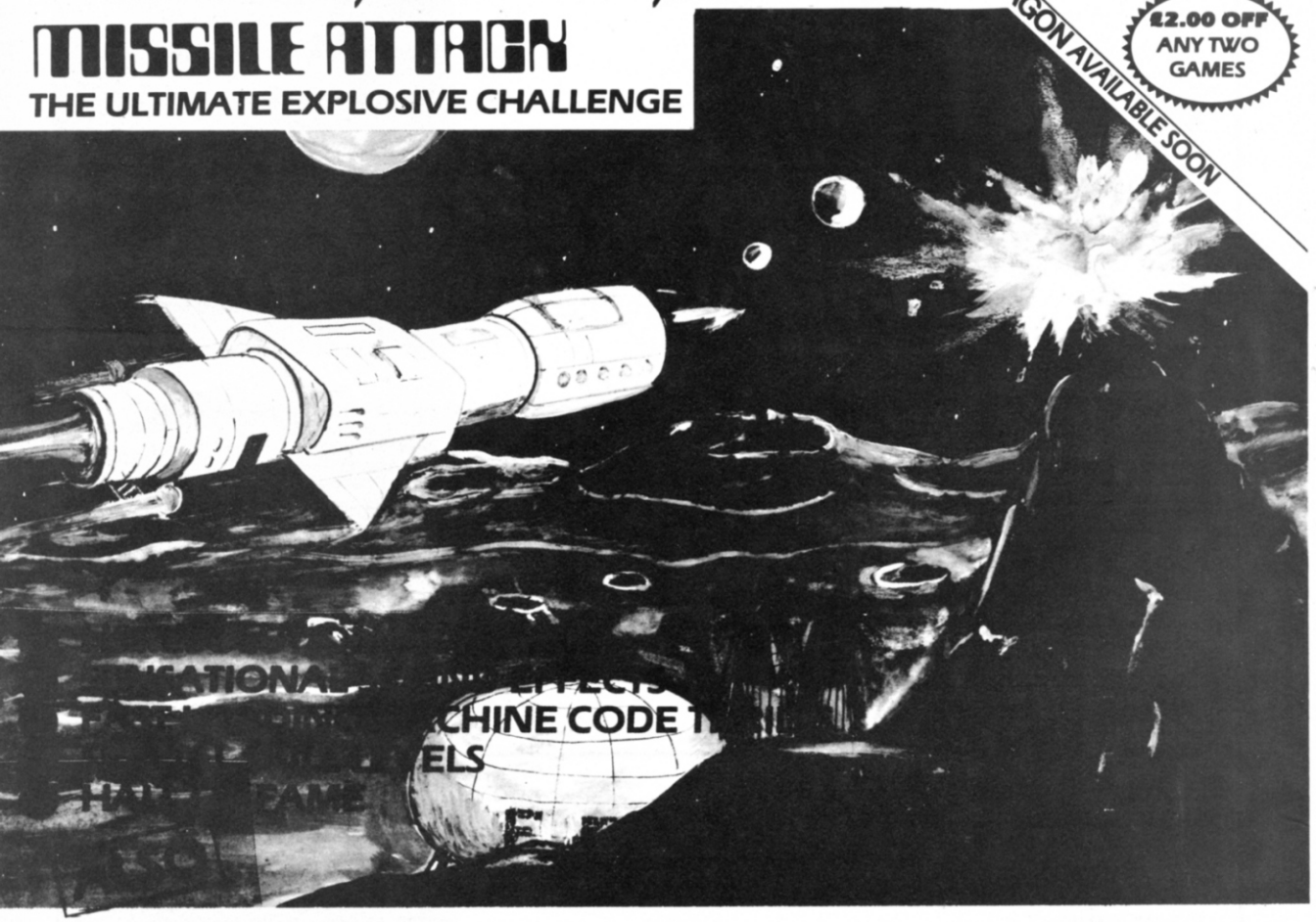

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PCN Programcards

Encode Card 1 of 1

8303Sub E

A subroutine to take a string of data and encode it using rectangular binary transposition of 8-byte blocks. Due to the symmetry of the routine, decoding of data uses the same routine.

```
1900  REM  INPUT          A$      - String to be Encoded/Decoded
1910  REM  LOCAL          N,L,IX  - Loop counters
1920  REM                 CT,RM   - Loop limiters
1930  REM                 CH      - Character being worked on
1940  REM  OUTPUT         B$      - Encoded/Decoded string
1950  REM                 RQ      - Return code. 0 - OK. 9 - Empty string
1960  REM  NOTE           A(7,7)    MUST be dimensioned in program.
2000  IF A$ = "" THEN RQ = 9: RETURN
2010  FOR N = 0 TO 7
2020  FOR L = 0 TO 7
2030 A(N,L) = 0
2040  NEXT L: NEXT N
2050 B$ = "":CT =  INT ( LEN (A$) / 8):RM =  LEN (A$) - CT * 8
2060  IF RM = 0 THEN CT = CT - 1:RM = 8
2070  FOR N = CT TO 0 STEP  - 1
2080  FOR L = 1 TO RM
2090 CH =  ASC ( MID$ (A$,N * 8 + L,1))
2100  FOR IX = 0 TO 7
2110 A(L - 1,IX) =  INT (CH / 2 ^ (7 - IX))
2120 CH = CH - ( INT (CH / 2 ^ (7 - IX))) * 2 ^ (7 - IX)
2130  NEXT IX: NEXT L
2140 RM = 8
2150  FOR L = 1 TO RM
2160 CH = 0
2170  FOR IX = 0 TO 7
2180 CH = CH + A(IX,L - 1) * 2 ^ (7 - IX)
2190  NEXT IX
2200 B$ = B$ +  CHR$ (CH)
2210  NEXT L: NEXT N
2220 RQ = 0: RETURN
```

Although written in Microsoft Basic this should work with only minor changes on all machines. Can be defined as BBC Basic PROCEDURE.

1900 *A$* must have length not greater than 248

1960 *A(7,7)* is the binary array
2000 Empty string
2010 Set array *A* to zero

2050 *CT*— How many blocks of 8. *RM*— remainder
2070 For each block of 8. Highest end first, lowest last
2090 Extract ASCII value of character
2100 Convert to binary and store in Array *A* horizontally

2140 Set output to MOD 8
2150 For each output character

2180 Convert to ASCII from binary using array *A* vertically
2200 Build up output string
2210 Continue until string *A$* exhausted
2220 Return to mainline program

PCN Programcards

Encode/Decode Card 1 of 1

8303ED

A short program to show the use and facilities of subroutine ENCODE. Accepts a password and a string of characters then displays coded form and original from coded data.

```
10  REM   This program demonstrates the use of Subroutine ENCODE
20  DIM A(7,7)
25  REM    Password to be used. Will be concatenated to front-end of input
      string
30  PRINT "PLEASE INPUT YOUR PASSWORD"
40  INPUT "";P$: IF P$ = "" THEN  PRINT "PROGRAM TERMINATED": END
50  PRINT "PLEASE ENTER STRING TO BE ENCODED"
60  INPUT "";I$: IF I$ = "" THEN  GOTO 30
65  IF  LEN (P$) +  LEN (I$) > 248 THEN  PRINT "DATA TOO LONG - RE-ENTER":
      GOTO 50
67  REM  Length of A$ MUST be less 249 such that string and password do
     not exceed maximum allowable string length when encoded into B$
70 A$ = P$ + I$

80  GOSUB 2000
90  IF RQ = 9 THEN  PRINT "STRING IS EMPTY - RETRY" GOTO 30
100  PRINT "HERE IS ENCODED STRING IN DECIMAL ASCII"
105  REM  To show that the string has been encoded beyond recognition it
     is displayed in DECIMAL representation of ASCII characters
110  FOR S = 1 TO  LEN (B$)
120  PRINT  STR$ ( ASC ( MID$ (B$,S,1)));".";
130  NEXT S
140  PRINT : PRINT "HERE IS THE ORIGINAL STRING AGAIN"
150 A$ = B$

160  GOSUB 2000
165  REM  Strip off password and display the original string as entered
170  PRINT  MID$ (B$, LEN (P$) + 1, LEN (B$) -  LEN (P$))
180  GOTO 50
```

Apple II
Applesoft Basic

20 Array *A(7,7)* is for use in ENCODE

40 If no password entered then END

60 If no strings entered then allow option of exit

70 *A$* is sum of password and string passed to ENCODE
80 Wait while encoding takes place

120 Print each character as a number (0-255) with "." between

150 Encoded string becomes input to ENCODE
160 Wait while decoding takes place

170 Print original string to compare visually
180 Another string?

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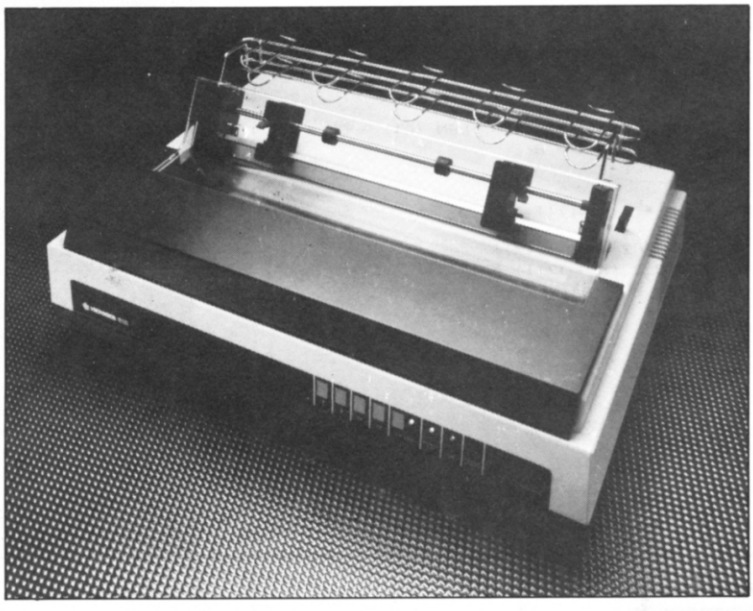

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CLUBNET

Clubnet keeps you in touch with the microcosm of personal computer enthusiasts throughout the UK. It is divided into two sections — Clubs and User Groups.

Each week we list clubs alphabetically by county and user groups alphabetically by speciality, covering about two letters of the alphabet each week.

Entries include up-to-date information as far as possible, and group organisers should let us know of any changes, particularly a move to a new address.

Just started your own club? Drop us a line and we'll spread the word. Write to: Clubnet, Personal Computer News, 62 Oxford Street, London W1A 2HG.

Details of the clubs are based on the Amateur Computer Club's listing.

CLUBS

CHESHIRE

Altrincham Computer Club. Meets at N. Cestrian Grammar School, Durham Road, Altrincham, fortnightly.

Contact Martin Hickling at 39 Barrington Road, Altrincham, Cheshire, WA14 1H2, tel: 061-941 4547.

Brunel Computer Club meets at St Werburgh Community Centre on alternate Wednesdays at 7 to 10pm.

Contact Mr R Simpson at 4 The Coots, Stockwood, Cheshire.

Cheshire Computer Club: contact W Collins at 37 Garden Lane, Chester, Cheshire.

Crewe Computer Users Club meets at Buffaloes Club, Earl Street, Crewe, Cheshire, on the third Thursday of each month at 8pm.

Contact Bram Knight on 0270-623375.

Holmes Chapel Micro Club meets at Leisure Centre, Holmes Chapel at 7.30 to 9.30pm on the first and third Tuesday of each month. Annual subs: £5 adults; £2.50 children, OAP and students. Or weekly subs: 30p adults, 20p children.

Younger members play games. There is some interest in developing hardware and writing programs.

Contact Margaret Baker, at 1 Helton Close, Crewe, Cheshire, tel: 0477-34238.

New Mills & District PCC meets at New Mills School, fortnightly on Fridays at 7 to 9.30pm, meetings 35p.

Machines available at meetings include ZX81, Vic-20, Spectrum, Apple, TRS-80 adn BBC.

Contact Mr G M Flanagan at 11 Sundown Close, New Mills, Stockport, Cheshire SK12 3DH, tel: 0663-44051.

Northwest Computer Club meets fortnightly, meetings 25p.

Contact John Lightfoot at 13 Aston Drive, Frodsham, Warrington, Cheshire WA6 7PU, tel: 0728 31519.

North West Computer Club, weekly meetings.

Annual subs: £1; meetings 30p (visitors 50p).

Contact Tom Wyatt at 29 Summer Lane, Halton, Runcorn, Cheshire WA7 5PG, tel: Runcorn 77545.

CLEVELAND

Cleveland Micro Club meets on the second and third Tuesday of each month, under 18s on second of the month, over 21s on third Tuesday of the month.

Contact J Telford at 13 West on Crescent, Norton.

USER GROUPS

BBC

BEEBUG. Produces ten magazines a year with programs for the BBC micro user. Discount deals, library and query service.

Contact Sheridan Williams or David Graham at PO Box 50, St Albans, Hertfordshire AL1 2AR.

Preston Area BBC Micro User Group. Meets at Boatmans Arms, Marsh Lane, Preston, on the last Thursday of each month (annual subs: £5).

Occasional speakers.

Contact Duncan Coulter, Membership Secretary, 8 Briar Grove, Ingol, Preston. Lancashire, tel: 0772 725793.

Brent/Barnet Users Group. Meets on the last Sunday of each month (annual subs: £3).

Produces monthly newsletter. No fixed meeting place yet.

Contact Joseph Fox at 4 Harman Close, London NW2 2EA.

COMAL

Comal User Group. Meets at Polytechnic of North London, Holloway, on the second Wednesday of each month, term time (annual sub: £7.50).

Machines used during meetings are Vic-20, Pet and Commodore 64

Contact John Collins, tel: 75 74111.

COMMODORE ICPUG

ICPUG (Blackpool). Meets at Arnold School, Blackpool, on the third Thursday of each month.

Contact David Jarrett, 197 Victoria Road, Thornton Cleveleys, Blackpool FY5 3ST.

ICPUG (Carrickfergus). Contact David Bolton, 19 Carrickburn Road, Carrickfergus, Antrim BT38 7ND, tel: 09603 637 88.

ICPUG (Cheltenham). Meets at The Cheltenham Ladies College on the last Thursday of the month at 7.30 to 10pm.

Self help group with plenty of advice. Beginners to experts welcomed. Plenty of machines.

Contact Alison Schofield, 78 Hesters Way Road, Cheltenham, Gloucester, tel: 0242 580789.

ICPUG (Clwydd). Contact John Poole, 6 Ridgeway Close, Connah's Quay, Clwydd CH5 4LZ.

ICPUG (Corby). Contact Peter Ashby, 215 Wincohn Way, Corby, Northamptonshire, tel: 05363 4442.

ICPUG (Derby). Meets at Derby Professional Colour every other Tuesday at 7 to 9pm.

Contact Robert Watts on 0332 72569.

PCN DATELINES

PCN Datelines keeps you in touch with up-coming events. Make sure you enter them in your diary.

Organisers who would like details of coming events included in PCN Datelines should send the information at least one month before the event. Write to PCN Datelines, Personal Computer News, 62 Oxford Street, London W1A 2HG.

UK EVENTS

Event	Dates	Venue	Organisers
Engineering Software Exhibition	April 11-13	Imperial College, London	Computational Mechanics Centre, 0421-293223
Computer Technology Exhibition	April 13-16	Recreation Centre, Newton Aycliffe, Co Durham	Jan Huntley, Sedgefield District Council, Spennymoor 816166
Computer Open Day Exhibition	April 14	Midland Hotel, Manchester	Tony Kaminiski, Couchmead Communications, 01-778 1102
London Computer Festival	April 14-16	Central Hall, Westminster, London	Jean Lock, Secretary to the Consortium, 01-633 3348
The Personal Computer World Show	April 16-18	MacRobert Hall, Ingleston, Edinburgh	Tim Collins, Montbuild, 01-486 1951
Manchester Home Computer Show	April 21-23	Midland Hotel, Manchester	Peter Freebrey, ASP Exhibitions, 01-437 1002
HP 1000 Users Exhibition & Conference	April 26-28	Heathrow Penta Hotel, London	Conference Services, 01-584 4226
Computer Trade Show	April 26-28	Wembley Conference Centre, Wembley	John Cole, IPC Exhibitions, 01-643 8040
Midland Computer Show	April 28-30	Bingley Hall, Birmingham	Roy Bratt, IPC Exhibitions, 01-643 8040

OVERSEAS EVENTS

Event	Dates	Venue	Organisers
Computerised Office Equipment Exhibition	April 5-7	O'Hare Exposition Centre, Rosemont, Illinois, USA	Cahners Exposition Group, 0483-38085
International Computer, Computer & Robot Exhibition	April 14-20	Seoul, Korea	Korea Economic Daily, 441 Chungrimdong, Chung-ku, Seoul 100
Information Management Exhibition & Conference	April 26-28	McCormick Place, Chicago, USA	Tony May, Clapp & Poliak, 021-384 3384
Compec Europe Exhibition	May 3-5	Centre Rogier, Brussels	Tracey Cannon, IPC Exhibitions, 01-643 8040
National Computer Conference & Exhibition	May 16-19	Anaheim, USA	American Federation of Information Processing Societies, 1815 N Lynn Street, Arlington, VA 22209

DATABASICS

This five-page guide lists as many of the micros on the market for under £12,000 as possible. In Databasics you'll find all the specifications for the machines, add-ons and software necessary to make your buying decisions.

PCN keeps you up to date in three-week cycles, starting with hardware, then peripherals and finally software.

PRICE Specifications listed for each machine indicate what you get for the basic price quoted, which includes VAT.

PROCESSOR TYPE a microprocessor is the heart of the computer. The Z80 and 6502 are popular 8-bit chips. The 8088 and 68000 are common 16-bit chips. If a machine has an 8-bit and a 16-bit processor we have listed the 16-bit only. Cust. means custom-built.

SPEED IN MHz Speed of the clock used to drive the microprocessor, measured in MegaHertz (thousand cycles per second).

STANDARD RAM Amount of main memory used on the system. The capacity is expressed in kilobytes.

MAX RAM normally at extra cost Amount of memory to which the system can be expanded.

MAX CHARACTERS lines × columns The number of characters that can be displayed across the screen and the number of lines down.

METHOD (at extra cost) This indicates the way the computer displays information. **M** on its own means that a monitor is included in the basic price. **Tv** indicates that you can plug the computer into a television set (**M+**) indicates that the monitor costs extra. **LCD** = Liquid crystal display.

COLOUR CAPABILITY tells you whether the machine can give colour at the basic price quoted.

MAX DOT RESOLUTION gives the maximum number of points across the screen by the number of points down the screen that are available for graphics.

KEYBOARD This tells you the type of keyboard that comes with the machine. **W** = word processing, **C** = calculator and **T** = touch-sensitive.

No OF FUNCTION KEYS refers to the number of keys that can be used for different jobs by different programs.

NUMERIC PAD indicates whether the machine has a separate calculator-style group of number keys to enter data quickly.

INTERFACES BUILT-IN shows the number of standard connections built into the machine.

CASSETTE FACILITY gives a yes or no as to whether or not the machine can use a cassette to store data.

CAPACITY PER DISK AND DISK SIZE tells you how many disk drives come with the machine, and the amount of data in kilobytes (K) or megabytes (Mb) that can be stored on each drive. There are two sizes for disks, 5¼" or 8", and they can be floppy **(F)** or hard **(H)**.

OPERATING SYSTEM gives the program that looks after the general running of a computer.

LANGUAGES INC is a column which lists the programming languages that come with the machine at the basic price.

OTHER LANGUAGES AVAILABLE indicates whether or not other programming languages are available for the machine.

DISTRIBUTOR To find which company distributes the machine refer to the distributor table from the code listed in this column. The table is at the end of the listings, and gives the distributor's name and telephone number.

All details given are the latest available. We ask distributors to let us know as soon as machine specifications change so Databasics can be kept right up to date. This guide has been meticulously researched and the information collected from individual distributors listed.

PRICE GUIDE

Sinclair ZX81	£50
Tandy TRS-80 Pocket	£57
Sharp PC1251	£80
Jupiter Ace	£90
Casio FX702P	£90
Oric 1	£100
Sinclair Spectrum	£125
TIT1-99/4A	£150
Atari 400	£160
Commodore VIC 20	£170
Sharp PC1500	£170
Acorn Atom	£174
Tandy TRS-80 Pocket 2	£179
Tandy TRS-80 Model 1	£199
Dragon 32	£200
Sord M5	£218
Colour Genie	£224
Camputers Lynx	£225
Tandy TRS-80 Colour	£240
New Brain A	£269
BBC Micro Model A	£299
Genie II	£299
Multitech MPS II	£299
Nascom 2	£327
Genie I	£330
Commodore 64	£345
BBC Micro Model B	£399
Atari 800	£400
Datac Micro Controller	£431
Cortex	£454
Epson HX20	£472
Nascom 3	£549
Sharp MZ80A	£549
Commodore 4016	£632
Research Machine 480Z	£650
DAI PC	£684
Apple II	£776
Commodore 500	£799
HP 75C	£883
Sharp MZ80B	£900
Commodore 8032	£1,129
Commodore 710	£1,144
Microdecision	£1,144
Fujitsu FM8	£1,150
Sanyo MBC 1000	£1,195
Positron 900	£1,259
Commodore 8096	£1,374
Pasca 640	£1,437
NEC PC8000	£1,454
Irvine Business Systems	£1,489
Televideo TS-800 Series	£1,495
HP 86A	£1,541
Osborne I	£1,581
Signet 10025	£1,599
APL Signet	£1,610
Zenith Z89-81	£1,668
Basis 108	£1,683
Tandy TRS-80 Model III	£1,699
Commodore Spr. Pet 9000	£1,719
Gemini Galaxy 2	£1,719
British Micro Mini 803	£1,720
Microsolution Brit. Genius	£1,840
Toshiba T-100	£1,900
Sord M23	£1,932
Transtec BC2	£1,949
Kenilworth 83G	£1,953
Transam Truscan	£1,983
IDS Datamachine	£1,995
Tandy TRS-80 Model	£1,999
Kenilworth 83N	£2,012
Caltext Micro	£2,019
LSIM3	£2,064
Haywood 9000 Composite	£2,064
Hawk Model 110	£2,070
Positron 9000	£2,134
Research Machines 380Z	£2,147
Future Computers FX-20	£2,156
Comart Communicator	£2,180
Superbrain JR	£2,185
Adler Alphatronic P2	£2,197
Genei III	£2,242
Kemitron K2000E	£2,242
Rair Black Box 320S	£2,242
Sanyo MBC 2000	£2,242
Toshiba T-200	£2,242
TMK 332	£2,242
Bonsai SM 3000	£2,294
CAL PC	£2,294
North Star Horizon	£2,294
Sanyo MBC 1250	£2,294
Casu Mini C2	£2,300
Seed System I	£2,300
Sharp PC3201	£2,300
HP 85	£2,360
HP Series 100, 120	£2,362
Sord M23P	£2,369
IBM PC	£2,392
Xerox 820 Model II	£2,415
Haywood 3000	£2,439
LSIM4	£2,472
Canon CX-1	£2,500
Adler Alphatronic P2U	£2,524
IO Tech Iona	£2,539
HP 87XM	£2,571
Quantum 2000	£2,587
Seed System 19	£2,600
Enterprise 1000	£2,645
Facit 6520	£2,645
Olympia Boss Model A	£2,645
Britannia Baby	£2,657
Adler Alphatronic P3	£2,696
Eagle II	£2,702
Almarc 801	£2,708
DEC Rainbow 100	£2,714
ICL PC Model 10	£2,754
Millbank SX10	£2,754
Olivetti M20D	£2,754
Sirius I	£2,754
Victor 9000	£2,754
North Star Advantage	£2,766
Apple III	£2,780
Sanyo MBC 4050	£2,817
Bonsai SM 4000	£2,842
Logica VTS Vitesse	£2,863
Decision-1 Computer O11	£2,869
Eagle III	£2,950
Zenith Z89-81	£2,978
Monroe EC 8800	£2,990
Philips P3500	£3,000
Tanberg EC10	£3,000
Archives 1	£3,003
Cromemco System 1	£3,025
DECPC 325	£3,080
Direct 1000	£3,093
Equator	£3,099
Clenio Table-Tops 925	£3,105
ITT 3030	£3,105
Monroe OC 8810	£3,162
HP Series 200 Model 16A	£3,211
Samurai	£3,214
Torch	£3,214
Sord M223	£3,277
Kontron RS180	£3,306
Columbia PC 1600-1	£3,392
Digico Prince	£3,392
Barcellos AMT 100	£3,450
Kalamazoo 1050	£3,450
Cromemco System 2	£3,560
Digital Microsystems 3	£3,576
Decision-1 Computer 012	£3,674
Televideo TS 1602-C	£3,714
Adds Multivision	£3,795
Clenio Pronto	£3,795
Panasonic JD800M	£3,795
Kemitron K3000	£3,795
DEC PC 350	£3,850
Vector 4	£3,852
Sage II	£4,019
Eagle IV	£4,190
C-1010	£4,197
Tandy TRS-80 Model 16	£4,199
Hytech H4500	£4,310
BMC OK11F800, Model 20	£4,360
ADS 42	£4,500
Televideo TS-80ZH	£4,533
Corvus Concept	£4,887
ICL PC Model 31	£4,939
Cromemco System 3	£5,170
Micro Five 1000	£5,175
Fortune 32:16 System 2	£5,204
Zeus 4	£5,400
Hawk Model 2110	£5,405
Molecular M200	£5,462
Altos 800/15	£5,663
Durango F85	£5,744
Marin Chip M9900	£5,750
SW Tech. Products S0/9	£5,750
BASF 7100	£5,805
Sord M243	£5,842
Archives IV	5,905
ICL PC Model 32	£6,037
Rair Business Computer	£6,037
Digital Microsystems 4	£6,210
Superstar	£6,296
Racal 6000	£6,327
Eagle 1600	£6,497
TI System 200-250	£6,695
Compucorp 675	£6,780
Sundance I	£6,969
Pascal Mod. Microengine	£7,003
Diablo 3000	£7,250
Onyx 5001 MU	£7,607
Sundance II	£8,205
Haywood Hinet	£9,550
Altos 856-10	£9,631
Micro Five 3000	£10,350
Sundance 16	£10,480
Spectrum	£11,442

ABBREVIATIONS

Ap: APL
As: Assembly
Ba: Basic
Co: Cobol
Cm: Comal
Fr: Forth
Fn: Fortran
Pa: Pascal

HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display: Max characters lines × columns	Display: Method (at extra cost)	Display: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Interfaces built-in: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
Acorn Atom	£174	6502	1	2K	40K	32×16	Tv(M+)	●	256×192	W							1	●		Cassette	BaAs	●	A1	Hobbyist micro
Adds Multivision	£3,795	8085A	5	64K	256K	80×25	M		640×240	W	28		1			1			1×350K5¼F	CP/M2.2, Muon	Ba	●	A2	Multi user system
Adler Alphatronic P2	£2,197	8085A	3	48K	64K	80×24	M			W	6	●	2			1	3		2×160K5¼F	CP/M	Ba	●	T1	Good software choice
Adler Alphatronic P2U	£2,524	8085A	3	64K		80×24	M			W	6	●	2			1	3		2×320K5¼F	CP/M	Ba	●	T1	£327 buys extra storage
Adler Alphatronic P3	£2,696	8085A	3	64K		80×24	M			W	6	●	2			1	3		2×790K5¼F	CP/M		●	T1	16 bit option-promised
ADS 42	£4,500	8085A	4	32K		40×8	M		40×8	W		●	3				3	●	1×82K5¼F	Holland Automation	Ba		A3	Intelligent cash register
Almarc 801	£2,708	Z80	4	64K	512K	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M		●	A4	8-bit range goes to 20Mb
Almarc 1601	£3,445	8086	8	128K	1Mb	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M86		●	A4	Pseudo 16-bits go to 20Mb
Altos 800/15	£5,663	Z80	4	192K	208K	80×24	M			W	8	●		1					1×450K5¼F	MP/M		●	L1	Multi user business machine
Altos 856-10	£9,631	8086	10	512K	1Mb	80×24	M			W	16	●	6						2×500K5¼F	Xenix	Xenix	●	L1	The 16-bit version
APL Signet	£1,610	Z80A	4	64K		80×25	Tv(M+)*	●		*			2						2×188K5¼F	APL, CP/M	Ap	●	M1	*APL terminal recommended
Apple II	£776	6502	1	48K	128K	40×24	Tv(M+)	●	256×192	W							8	●		CP/M, DOS 3.3, UCSD-P	Ba	●	A8	Plenty of software and extras
Apple III	£2,780	6502	2	128K	256K	80×24	(M+)	●	560×192	W		●	1				4		1×140K5¼F	SOS, DOS		●	A8	Will emulate Apple II
Archives I	£3,003	Z80	4	64K		80×25	M	●	240×100	W	23	●	2	1		1	5		2×386K5¼F	CP/M		●	S1	Standard CP/M + graphics
Archives IV	£5,905	Z80	4	512K		80×25	M	●	240×100	W	23	●	1			1	3		1×10Mb5¼H+1×7445¼F	CP/M, MP/M		●	S1	Hard disk version
Atari 400	£160	6502B	1.79	16K		40×24	Tv	●	320×160	T						7		●		Cassette		●	A5	Games computer, Basic extra
Atari 800	£400	6502	1.8	16K	48K	40×24	Tv(M+)	●	320×192	W						7	4	●		Cassette	Ba	●	A5	Versatile, good graphics
Barcellos AMT 100	£3,450	Z80A	4	64K	256K	80×24	TvM			W	8	●	1	1		2	3		2×500K8F	CP/M	BaCo	●	B1	Up to four users
BASF 7100	£5,805	Z80A	4	64K		80×24	M			W	26	●	1	1					3×163K5¼F	BOS	Ba	●	C1	Hard disc promised
Basis 108	£1,683	6502	1	64K	126K	80×24	TvM	●	820×168	W	15	●	1	1			6	●				●	C12	Apple bus, Z80, 80 columns
BBC Micro Model A	£299	6502	1.8	16K	32K	40×30	Tv(M+)	●	320×256	W	10					1		●		MOS	BaAs	●	A1	Upgradable to Model B
BBC Micro Model B	£399	6502	2	32K		80×30	Tv(M+)	●	640×256	W	10			1		5	3	●		MOS	BaAs	●	A1	Versatile and expandable
BMC OKI if 800, Model 20	£4,360	Z80B	5	64K	256K	80×25	M	●	640×200	W	15	●	1					●	2×340K5¼F	CP/M	Ba	●	E1	Built-in printer
Bonsai SM 3000	£2,294	Z80	2	64K		80×24	M		80×24	W	14	●	1	1					2×350K5¼F	CP/M		●	B2	CP/M business machine
Bonsai SM 4000	£2,842	8088	5	128K	256K	80×24	M			W	14	●	1	1						CP/M, MP/M, MS-DOS		●	B2	Z80 for 8 bit software
Britannia Baby	£2,657	8085	6.14	64K		80×25	Tv(M+)		80×25	W	11	●	2	1					2×500K5¼F	CP/M	AsBaCo	●	B3	Cobol language included
British Micro Mimi 803	£1,720	Z80A	4	64K		80×25	(M+)		512×256	W	17	●	1	1		1			2×400K5¼F	OS/M		●	B4	This is CP/M compatible
C-1010	£4,197	6502	1	64K	128K	80×24	TvM		256×192	W	12	●	1	1		1	8	●	1×1405¼F+1×10MbH	CP/M, DOS, UCSD-P	Ba	●	C2	Apple II compatible
CAL PC	£2,294	8088	5	128K	256K	80×25	TvM	●	256×512	W		●	2	1		1	5		2×400K5¼F	CP/M	Ba	●	C3	Also Z80B Processor
Caltext Micro	£2,019	Z80A	4	64K	256K	80×24	TvM			W	36	●	1	1			3		2×400K5¼F	CP/M		●	C3	Range of software included
Camputers Lynx	£225	Z80A	4	48K	192K	40×24	Tv(M+)	●	248×256	W			1	1				●		Cassette	Ba	●	C5	Unusual — promise of CP/M
Canon CX-1	£2,500	6809	4	128K	256K	80×24	M		80×25	W	15	●	3	1	1		2		2×320K5¼F	MCX	BaAs	●	C4	Pascal, Fortran as extras
Casio FX 702P	£90	Cust.		2K		20×1	LCD			C								●		Cassette	Ba		C6	Pocket computer
Casu Mini C2	£2,300	Z80A	4	64K		*	(M+)		*	*			4	1			6		2×1Mb8F			●	C7	*Choose your own terminal
Clenlo Pronto	£3,795	Z80A	4	64K	1Mb	*	Tv(M+)		*	*			2	2			18		2×600K8F	CP/M	Ba	●	C8	*Choice of terminal
Clenlo Table-Top 925	£3,105	Z80A	4	64K	128K	80×25	M			W	11	●	2	2					2×600K8F	CP/M		●	C8	Watch out for the weight
Columbia PC1600-1	£3,392	8088	4.77	128K	1Mb	80×24	M	●	640×200	W	10	●	2	1			8		2×320K5¼F	CP/M, MS-DOS	Ba	●	I1	An IBM lookalike
Commodore VIC 20	£170	6502	1	5K	32K	22×23	Tv(M+)	●	176×158	W	8					3	1	●		Kernal	Ba	●	C9	Very popular home micro
Commodore 64	£345	6510	1	64K		40×25	Tv(M+)	●	320×200	W	8					3		●		Kernal	Ba	●	C9	Good value for money
Commodore 500	£799	6509	1	128K	896K	40×25	Tv(M+)	●	320×200	W	10	●	1		1	3	1	●		Kernal	Ba	●	C9	Available by summer?
Commodore 4016	£632	6502	1	16K	32K	40×25	TvM			W		●			1	1	3	●		Cassette, PETDOS	Ba	●	C9	The original PET
Commodore 710	£1,144	6509	2	128K	896K	80×25	TvM			W	10	●	1		1	2	1	●		Kernal	Ba	●	C9	Might be a long wait
Commodore 8032	£1,129	6502	1	32K	96K	80×25	TvM			W		●	*		1	1		●		Cassette, PETDOS	Ba	●	C9	The 80-column PET
Commodore 8096	£1,374	6502	1	96K		80×25	TvM			W		●			1	1		●		Cassette, PETDOS	Ba	●	C9	Fully expanded PET
Commodore Super Pet 9000	£1,719	6502	2	96K		80×25	TvM			W		●	1		1	1	2	●		Cassette, PETDOS	Ba	●	C9	Top of the range

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display			Graphics	Keyboard			Interfaces built-in				Storage		Operating system	Languages inc	Other languages available	Distributor	Comments
						Max characters lines × columns	Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots	Cassette facility	Capacity per disk and disk size					
Compucorp 675	£6,780	Z80	4	64K	256K	80×20	M			W	20	●	1				4		2×655K5¼F	Compucorp		●	C10	Unusual O/S
Comart Communicator CP100	£2,180	Z80	4	64K	512K	80×24	M			W		●	2	1			10		2×390K5¼F	CP/M		●	C13	Business CP/M micro
Cortex	£454	9995	12	64K	1Mb	40×24	Tv(M+)	●	256×192	W	12	●	1					●			BaAs		M2	Mainly sold as £340 kit
Corvus Concept	£4,887	68000	8	256K	1Mb	120×60	M		720×560	W	10	●	2			1	4			Merlin	Pa	●	K1	A4 shaped screen
Cromemco System 1	£3,025	Z80	4	64K		80×24	(M+)	●	450×735	W	20	●	1				8		2×390K5¼F	CDOS, Crom		●	C13	Designed for business
Cromemco System 2	£3,560	Z80	4	64K		80×25	(M+)			W	20	●	1				21		2×390K5¼F	CDOS, Crom		●	C13	Large business machine
Cromemco System 3	£5,170	Z80	4	64K		80×25	(M+)			W	20	●					21		2×1.2Mb8F	CDOS, Crom		●	C13	Top end Cromec
DAI PC	£684	8080	2	48K		60×24	Tv(M+)	●	255×335	W			1					●		Cassette	Ba		D9	Optional maths chip
Datac Micro Controller	£431	Z80	2	16K		40×24	Tv(M+)		80×60	W			1			1	1	●			Ba	●	D1	Mainly used in labs
DEC Rainbow 100	£2,714	8088	N/A	64K	192K	132×24	M	●	960×240	W	20	●	2				3		2×400K5¼F	CP/M		●	D2	Competitor for IBM PC
DEC PC 325	£3,080	PDP11/23	N/A	256K		132×24	M	●	960×240	W	20	●	2				1		2×400K5¼F	P/OS		●	D2	Mini in micro clothing
DEC PC 350	£3,850	PDP11/23	N/A	256K		132×24	M	●	960×240	W	20	●	2				4		2×400K5¼F	P/OS		●	D2	Mini in micro clothing
Decision-1 Computer MDC-011	£2,869	Z80A	4	64K	192K		(M+)*			*			3	1		1			2×400K5¼F	CP/M	Ba	●	I2	*Buy your own terminal
Decision-1 Computer MDC-012	£3,674	Z80A	4	64K	192K		(M+)*			*			3	1		1			1×400K5¼F+1×5Mb5¼H	CP/M	Ba	●	I2	*You choose the terminal
Diablo 3000	£7,250	8085	3	32K	64K	80×24	M			W	8	●	1				4		2×1.8Mb8F	DACL	Ba	●	B5	Unusual O/S
Digico Prince	£3,392	Z80A	4	64K		80×25	M			W	50	●	2				7		2×400K5¼F	CP/M		●	D3	Unusual keyboard
Digital Microsystems DMS-3	£3,576	Z80A	4	64K			(M+)*			*			3			1			2×512K8F	CP/M		●	D4	*Choice of terminal
Digital Microsystems DMS-4	£6,210	Z80A	4	128K	½Mb		(M+)*			*			4						2×512K8F	MP/M		●	D4	*Depends on terminal chosen
Direct 1000	£3,093	Z80	4	64K		80×25	M		132×28	W			2						2×300K5¼F	CP/M		●	D5	Standard CP/M machine
Dragon 32	£200	6809E	1	32K	64K	32×16	Tv(M+)	●	256×192	W				1		4	1	●		Cassette	Ba		D6	Tandy colour lookalike
Durango F85	£5,744	8085A	5	64K	196K	80×64	Tv(M+)			W		●	4			1	12		2×1Mb5¼F	Star Basic	BaCo	●	C3	Built in printer
Eagle II	£2,702	Z80A	4	64K		80×24	M		80×24	W		●	2	1		1			2×500K5¼F	CP/M	Ba	●	M3	Includes WP/SS software
Eagle III	£2,950	Z80A	4	64K		80×24	M		80×24	W		●	1						2×1Mb5¼F	CP/M	Ba	●	M3	Includes WP/SS software
Eagle IV	£4,190	Z80A	4	64K		80×24	M			W		●	2	1		1			1×1Mb5¼F+1×12.5Mb5¼H	CP/M	Ba	●	M3	Includes WP/SS software
Eagle 1600	£6,497	8086	8	128K	512K	80×25	M	●	720×352	W	24	●	2	1		1	8		1×1Mb5¼F+1×12.5Mb5¼H	MS-DOS, CP/M 86		●	M3	High speed IBM copy
Enterprise 1000	£2,645	*	8	64K			M			W	10	●	2			2			2×358K5¼F	Enterprise		●	D7	Micro Nova 16-bit
Epson HX20	£472	6301	1	16K	32K	20×4	LCD		120×32	W	13	●	2				2	●		Cassette	Ba		E2	Powerful portable
Equator	£3,099	Z80A	4	64K	448K	80×24	M		80×24	W		●	2	1		1	12		2×350K5¼F	CP/M, MP/M, Turbo DOS		●	E3	Two bigger models available
Facit 6520	£2,645	Z80	4	64K	128K	80×24	M		80×24	W	8	●	2						2×320K5¼F	CP/M, Facit DOS	Ba	●	F1	Concurrent printing
Fortune 32:16 System 2	£5,204	68000	6	256K	1Mb	80×24	M	●	1024×1024	W	16	●	1				20		2×800K5¼F	Unix		●	I3	Genuine 16-bit
Fujitsu FM8	£1,150	6809	1	64K		80×25	(M+)	●	640×200	W	10	●	1	1		4	1	●		Flex	Ba		S2	Good for business graphics
Future Computers FX-20	£2,156	8088	8	128K	1Mb	80×25	M		800×400	W	20	●	2			2			2×800K5¼F	CP/M 86, MS-DOS		●	E1	Still on a promise
Genie I	£330	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48	W			1	1			1	●		Cassette	Ba	●	L2	Compatible with TRS 80/I
Genie II	£299	Z80	3.25	16K	48K	64×16	Tv(M+)		128×48	W	4	●	1				1	●		Cassette	Ba	●	L2	Speeded-up Genie I
Genie III	£2,242	Z80A	4	64K		80×24	M		160×72	W	8	●	1	1		1	3		2×700K5¼F	New DOS	Ba	●	L2	CP/M costs extra
Colour Genie	£224	Z80	2.2	16K	32K	40×24	Tv(M+)	●	160×96	W			1	1		2	1	●		Cassette	Ba		L2	Home games machine
Gemini Galaxy 2	£1,719	Z80	4	64K	512K	80×25	M		160×75	W	10	●	1	1		1	5	●	2×400K5¼F	CP/M		●	G1	Low cost British system
Hawk Model 110	£2,070	Z80A	4	64K	256K	*	(M+)*	●	*	*			2	1			3		2×390K5¼F	CP/M, MP/M2		●	L6	*Choose your terminal
Hawk Model 2110	£5,405	Z80A	4	64K	256K	*	(M+)*	●	*	*			2	1			3		1×390K5¼F+1×21MbH	CP/M, MP/M2		●	L6	*Choose your terminal
Haywood 9000 Composite	£2,064	Z80A	4	64K	192K	80×25	M		64×255	W	34	●	2				8		2×320K5¼F	CP/M	As	●	H1	Designed for network
Haywood Hinet	£10,982	Z80	4	64K	128K	80×24	M			W	34	●	3	1		1			1×11Mb8H	CP/M		●	H1	Large network machine
HP 75C	£883	Cust.	N/A	16K	24K	32×1	(M+)			C						1	4	●	1.3K card reader	HP	Ba		H2	Calculator/computer
HP 85	£2,360	Cust.	N/A	16K	32K	32×20	M		255×191	W	8	●	1			4	4	●		Cassette	Ba	●	H2	Engineers' machine
HP 86A	£1,541	Cust.	N/A	64K	512K	80×24	M		544×240	W			1	1		2	4			HP	Ba	●	H2	CP/M optional
HP 87XM	£2,571	Cust.	N/A	128K	640K	80×24	M		544×240	W	14	●	1	1	1	3	4			HP DOS	Ba	●	H2	Special technical uses
HP Series 100, 120	£2,362	Z80A	3.68	64K		80×24	M		80×24	W	8	●	2			1				CP/M	Ba	●	H2	Top end HP business system
HP Series 200 Model 16A	£3,212	68000	8	128K	750K	80×25	M			W	5		1		1		2			HP		●	H2	Genuine 16-bit
Hytech H4500	£4,310	Z80	4	64K	208K	80×25	M		80×25	W	26	●	1				3		2×403K5¼F	CP/M	Ba	●	H3	Standard CP/M micro
IBM PC	£2,392	8088	4.7	64K	576K	80×25	(M+)	●	640×200	W	10	●		1			5		1×360K5¼F	MS-DOS	Ba	●	K2	Slow but reliable

Chromasonic Hall of Fame No.18

THE 'GRAPHICS DESIGNER', OR 'PRINT & PLOT CLOT,' FAILED ART SCHOOL STUDENT. ALWAYS PLOTTING SOMETHING OR OTHER. QUITE HAPPY WITH A FEW COLOURS IN TWO DIMENSIONS, BUT IN HIS ELEMENT CHASING TURTLES ABOUT. SPENDS SPARE TIME WRITING POTENTIAL SOFTWARE FOR WALT'S NEXT LAZER-CHIP MOVIE. SEES THE WORLD THROUGH PIXEL-TINTED SPECS. REGARDS THE PAINT-BRUSH AS SOMETHING FROM THE ARK. BUT SO ARE TURTLES!

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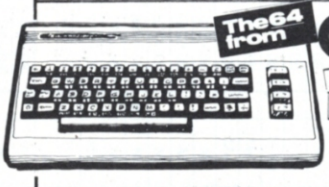

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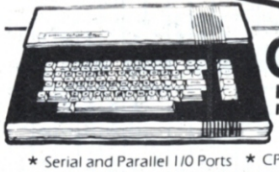

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Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display			Graphics	Keyboard			Interfaces built-in					Storage		Operating system	Languages inc	Other languages available	Distributor	Comments
						Max characters lines × columns	Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots	Cassette facility	Capacity per disk and disk size					
ICL PC Model 10	£2,754	8085	3	64K	256K	80×24	Tv(M+)			W	11	●	2				8		2×700K5¼F	CP/M	Ba	●	I4	Repackaged Rair Black Box
ICL PC Model 31	£4,939	8085	3	128K	256K	80×24	(M+)		80×24	W	11	●	4				8		1×250K5¼F+1×5MbH	CP/M, MP/M	Ba	●	I4	Multi user Black box
ICL PC Model 32	£6,037	8085	3	256K		80×24	(M+)		80×24	W	11	●	8				8		1×250K5¼F+1×5MbH	CP/M, MP/M	Ba	●	I4	Top of ICL range
IDS Datamachine	£1,995	Z80	4	64K	1Mb	*	Tv(M+)		*				2				15		2×400K5¼F	CP/M	Ba	●	I8	*Depends on terminal
IO Tech Iona	£2,539	Z80	4	69K	960K	80×24	M	●	160×75	W	12	●	1	1			8	●	2×400K5¼F	CP/M		●	I5	Good colour versatility
Irvine Business Systems	£1,489	Z80	4	64K		80×25	M			W		●	2						2×400K5¼F	CP/M		●	I6	Inexpensive CP/M machine
ITT 3030	£3,105	Z80A	4	64K	256K	80×24	Tv(M+)		80×24	W	8	●	1			1	1		2×280K5¼F	CP/M, BOS		●	I7	Top end business system
Jupiter Ace	£90	Z80	3.25	3K	51K	32×24	Tv(M+)		64×46	C		●					1	●			Fr		J1	Native Forth machine
Kalamazoo 1050	£3,450	8085	6	64K		80×24	Tv(M+)		80×24	W	10		1						2×250K5¼F	Kalamazoo		●	K3	Only Kabol language
Kemitron K2000E	£2,242	Z80	4	64K		80×24	(M+)		80×24	W			2	1			11		1×300K5¼F	CP/M		●	K4	Scientific Keyboard
Kemitron K3000	£3,795	Z80	4	64K	256K	80×24	(M+)		80×24	W		●	2				14		2×1Mb8F	CP/M, MP/M		●	K4	For scientific use
Kenilworth 83G	£1,953	Z80A	4	64K		80×25	TvM		160×75	W	10	●	1	1			5		2×350K5¼F	CP/M		●	K5	British portable
Kenilworth 83N	£2,012	Z80	4	64K		80×25	TvM		160×75	W	10	●	1	1			5		2×350K5¼F	CP/M	Ba	●	K5	Includes Basic
Kontron RSI 80	£3,306	Z80	4	64K	128K	80×25	M		256×512	W	16	●	2	1			8		2×303K5¼F	Kontron	Ba	●	K6	O/S CP/M based
LSI M3	£2,064	Z80	2.5	64K		80×24	M		80×24	W	31	●	1	1					2×200K5¼F	CP/M		●	L3	Big, British and CP/M
LSI M4	£2,472	8088	5	128K	256K	80×24	M		160×72	W	31	●	2	1			1		2×400K5¼F	CP/M 86, CP/M80		●	L3	Z80 for 8-bit software
Logica VTS Vitesse	£2,863	8086	5	64K	256K	80×24	M	●	640×288	W	12	●	1	1			4		2×1Mb5¼F	CP/M, MS-DOS	Ba	●	L4	High-res colour graphics
Marin Chip M9900	£5,750	9900	3	64K	1.6Mb	24×80	M		24×80	W	8	●	4				12		2×1.2Mb8F	MOS, MDEX	Ba	●	M2	Genuine 16-bit
Micro Five 1000	£5,175	8088	8	128K	512K	25×80	TvM		512×512	W	20	●	10				2		2×1Mb5¼F+2×6.3Mb5¼H	*		●	F2	*Choose your own O/S
Micro Five 3000	£10,350	8086	5	128K	1Mb	25×80	TvM		512×512	W	20	●	5				3	●	1×10Mb8F	*		●	F2	*Choose your own O/S
Microdecision	£1,144	Z80	4	64K		80×24	(M+)			*			2						1×200K5¼F	CP/M	Ba,Pilot	●	I2	*Terminal extra
Microsolution British Genius	£1,840	Z80	4	64K		80×24	TvM		80×24	W	21	●	1	1					2×160K5¼F	CP/M		●	M4	'Genius' by nature?
Millbank SX10	£2,754	Z80A	4	65K	256K	80×25	M		80×25	W	10	●	2			1			2×350K5¼F	CP/M	As	●	M5	Scientific applications
Molecular M200	£5,462	Z80	4	64K	320K		(M+)*			*			2			1	16		1×10Mb8H+1×500K8F	CP/M	BaAs	●	G2	*Terminal required
Monroe EC8800	£2,990	Z80A	3	128K		40×24	M		240×240	W	32	●	3			3			1×320K5¼F	Monroe	BaPaPilot	●	F3	Only 40-character screen
Monroe OC8810	£3,162	Z80A	3	128K		80×24	M		80×24	W	32	●	3			2	1		1×320K5¼F	Monroe	BaPa	●	F3	Bigger model available
Multitech MPFII	£299	6502	1.2	64K		40×24	Tv(M+)	●	280×192	C				1		1	1	●		Cassette	Ba	●	F4	Apple soft compatible
Nascom 2	£327	Z80A	4	2K	64K	16×48	Tv(M+)		48×96	W			1				4	●		NAS, SYS	BaAs	●	L5	Old reliable
Nascom 3	£549	Z80	4	48K		16×48	Tv(M+)		48×96	W			1				4	●		NAS, SYS	BaAs	●	L5	Fully expanded Nascom
NEC PC8000	£1,454	Z80	4	32K	64K	80×25	M	●	160×100	W	10	●	2	1					2×300K5¼F	CP/M, NEC, DOS	Ba	●	N1	Superb colour graphics
New Brain A	£269	Z80A	4	32K	512K	80×30	Tv(M+)		640×220	C			2				1	●		Cassette	Ba		G3	A lot of promise
North Star Advantage	£2,766	Z80	4	64K		80×24	M		640×240	W	15		1				6		2×360K5¼F	CP/M		●	T9	16-bit option
North Star Horizon	£2,294	Z80	4	64K	512K		*		*	*			2	1		1	9		2×360K5¼F	North Star DOS	Ba	●	T9	*Choose your own terminal
Olivetti M20D	£2,754	Z8000	3	160K	512K	80×25	M	●	512×256	W		●	1	1			5		2×320K5¼F	PCOS	Ba	●	B6	Real 16-bitter
Olympia Boss Model A	£2,645	Z80A	4	64K		80×28	M	●	80×28	W	10	●	1				4		2×140K5¼F	CP/M		●	O1	Useful 28 lines on screen
Onyx 5001 MU	£7,607	Z80A	4	128K	256K	*			*	*			5	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	*Terminal extra; other models
Oric 1	£100	6502A	1	16K	48K	40×28	Tv(M+)	●	240×200	C				1		1		●		Cassette	Ba		O2	Expects Delivery delays
Osborne 1	£1,581	Z80	4	64K		52×24	M		128×32	W	10	●	1		1				2×185K5¼F	CP/M	Ba	●	O3	Portable, includes software
Panasonic JD 800M	£3,795	8085A	4	60K		80×24	M		80×24	W	21	●	3						2×250K8F	CP/M	Ba	●	P1	Larger model costs £5,002
Pasca 640	£1,437	Z80A	4	64K		80×24	M			W		●	1	1					2×250K8F	CP/M		●	W1	Regular CP/M micro
Pascal Modular Microengine	£7,003	WD9000	2	128K		*	*		*	*			4				8		2×1.2Mb8F	UCSD-P	Pa	●	P2	*Terminal extra
Philips P3500	£3,000	Z80A	4	64K	320K	80×25	M			W	11	●	2						2×0.6Mb5¼F	Turbo-DOS	Co	●	P3	Fast O/S as standard
Positron 900	£1,259	6809	1	64K	256K	*	(M+)		*	*			4		1		3			O/S 9	Ba	●	P4	*You choose your terminal
Positron 9000	£2,134	6809	1	64K	256K	80×24	TvM	●	480×240	W	12	●	4		1		3			O/S 9	Ba	●	P4	Multi user version
Quantum 2000	£2,587	Z80A	4	64K	192K	80×25	M		160×75	W	18	●	1	1			5	●	3×860K5¼F	CP/M		●	Q1	Mono, low-res graphics
Rair Black Box Model 3/20S	£2,242	8085	5	64K	512K	80×24	(M+)			*			2				8		2×1Mb5¼F	CP/M	Ba	●	R1	*VDU extra; many versions
Rair Business Computer	£6,037	8088	5	256K	1Mb	80×25	M	●		W	10	●	2			4	8		1×19Mb5¼H+1×1Mb5¼F	CP/M, PCDOS	Ba	●	R1	Hybrid 8/16 bit
Racal 6000	£6,327	Z80	5	64K	256K	80×26	M		80×26	W	21	●	1	1					1×600K8F	CP/M		●	R2	CP/M languages available
Research Machines 380Z	£2,147	Z80A	4	32K	56K	40×24	Tv(M+)			W			1	1			4	●	2×144K5¼F	CP/M	Ba	●	R3	Widely used in schools

Research Machines Link 480Z	£650	Z80A	4	32K	256K	40×24	Tv(M+)			W	4		2	1		1	2	●		Cassette	Ba		R3	CP/Net version available
Sage II	£4,019	68000	8	128K	512K	*	(M+)		*	*			2	1	1				2×640K5¼F	UCSD-P System	BaAsPaFn	●	T10	*Terminal extra
Samurai	£3,214	8086	4.6	128K	768K	80×25	M	●	720×400	W		●	3	1			3		2×1.2Mb8F	MS DOS, CP/M 86		●	M6	High-res colour graphics
Sanyo MBC 1000	£1,195	Z80A	4	64K		80×25	M		80×25	W	17	●	1	1					1×320K5¼F	CP/M	Ba	●	L1	Standard CP/M model
Sanyo MBC 1250	£2,294	Z80	4	64K		80×40	M		640×400	W		●	1	1					2×640K5¼F	CP/M	Ba	●	L1	High-res graphics
Sanyo MBC 2000	£2,242	8085A	5	64K		80×24	M		80×24	W	24	●	2	1			2		2×328K5¼F	CP/M	Ba		L1	Big disc model costs £3,622
Sanyo MBC 4050	£2,817	8086	5	128K	512K	80×24	M		80×24	W			1	1					2×640K5¼F	CP/M 86	Ba	●	L1	Pseudo 16-bit
Seed System 1	£2,300	6800	2	32K	64K	80×24	M		80×24	W	3	●	2				8		2×160K5¼F	DOS 68 Flex	Ba	●	S3	Ageing business machine
Seed System 19	£2,600	6809	2	48K	1Mb	80×24	M			W	3	●	2				8		2×160K5¼F	OS-9		●	S3	Latest from Seed
Sharp MZ80A	£549	Z80	2	48K		40×25	M		80×50	W		●						●		Sharp Basic	Ba	●	S4	CP/M facility extra
Sharp MZ80B	£900	Z80A	4	64K		80×25	M		320×200	C	10	●						●●		Sharp Basic	Ba	●	S4	Unusual keyboard
Sharp PC1251	£79.95	Cust.	.58	4.2K			LCD		24×1	C	18	●					1	●●		Sharp Basic	Ba		S4	Pocket computer
Sharp PC1500	£170	Cust.	1.3	3.5K	11.5K	26×1	LCD		156×7	C	6	●	1	1			2	●		Cassette	Ba		S4	Optional 4-pen plotter
Sharp PC3201	£2,300	Z80A	2.6	64K	112K	80×25	M		160×50	W	10	●					5		2×500K5¼F	Sharp Basic	Ba	●	S4	Powerful Sharp Basic
Signet 10025	£1,599	Z80B	6	64K		80×24	M	●	512×512	W		●	2	1			1		2×200K5¼F	CP/M, Macnos		●	A6	Choice of keyboards
Sinclair ZX81	£50	Z80A	3.5	1K	16K	32×24	Tv		64×44	C							1	●●		Cassette	Ba		S4	Sold a million
Sinclair Spectrum	£125	Z80A	3.5	16K	48K	32×24	Tv	●	256×192	C							1	●●		Cassette	Ba	●	S4	Very popular home micro
Sirius I	£2,754	8088	5	128K	896K	80×25	M		800×400	W	7	●	2		1		4		2×600K5¼F	CP/M 86, MS/DOS	Ba	●	A7	IBM style
Sord M5	£218	Z80A	4	4K	16K	40×24	Tv(M+)	●	256×196	C				1		2		●		Cassette	Ba		S6	Japanese home computer
Sord M23	£1,932	Z80A	4	128K		80×25	M	●		W	14	●	2	1		2	3		2×330K5¼F	Sord O/S, SB80	BaPips	●	S6	CP/M compatible
Sord M23P	£2,369	Z80A	4	128K		80×25	Tv(M+)	●	640×200	W	14	●	2	1		2	2		2×290K3½F	Sord O/S, SB80	BaPips	●	S6	Complete with suitcase
Sord M223	£3,277	Z80	4	64K		80×25	M			W		●	2			4			2×350K5¼F	Sord O/S, SB80	BaPips	●	S6	Standard business machine
Sord M243	£5,842	Z80	4	192K		80×25	M	●	640×400	W	15	●	4	1		4			2×1Mb8F	Sord O/S, SB80	BaPips	●	S6	Large and powerful
SW Technical Products SO/9	£5,750	6809	2	256K	1.2Mb	80×24	M			W	15	●	1	1					2×1.5Mb5¼F	Flex, Uniflex		●	S7	Top end SWTP
Spectrum	£11,442	68000	8	256K	4Mb	*	(M+)		*	*			4				16		2×720K5¼F	Mirage	Ap	●	M1	*As terminal
Sundance I	£6,969	Z80A	4	64K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Ordinary CP/M machine

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						Max characters lines × columns	Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots	Cassette facility	Capacity per disk and disk size					
Sundance II	£8,205	Z80A	4	128K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Middle-range Sundance
Sundance 16	£10,480	Z8001	6	256K	1Mb	80×24	M			W		●	5	1				●	1×14Mb5¼H	BOS		●	T2	Tape backup for hard disc
Superbrain JR	£2,185	Z80	4	64K		80×24	M		560×240	W		●	1				1		2×160K5¼F	CP/M	Ba	●	I1	Bigger models available
Superstar	£6,296	Z80	4	64K		80×24	Tv(M+)		80×24				1	1			8		1×10Mb5¼H+1×400K5¼F	CP/M 80	Ba	●	B7	Includes hard disk
Tandberg EC10	£3,000	8080A	2	64K		80×25	M			W		●	7						1×250K8F	CP/M, TOS	Ba	●	T3	Very early machine
Tandy TRS-80 Model I	£199	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48	W		●						●		TRS-DOS	Ba	●	T4	Old faithful
Tandy TRS-80 Model II	£1,999	Z80A	4	64K	256K	80×24	M		80×24	W	2	●	2	1					1×500K8F	TRS-DOS	Ba	●	T4	Big business machine
Tandy TRS-80 Model III	£1,699	Z80A	2	48K		64×16	M		128×48	W		●	1	1		1		●	2×184K5¼F	TRS-DOS	Ba	●	T4	Latest TRS80
Tandy TRS-80 Model 16	£4,199	68000	8	128K	512K	80×24	M			W	2	●	2	1					2×1.2Mb8F	TRS-DOS	BaAs		T4	True 16-bit
Tandy TRS-80 Colour Computer	£240	6809E	1	16K	32K	32×16	Tv	●	256×192	W			1					●		Cassette	Ba	●	T4	Very popular
Tandy TRS-80 Pocket Computer	£57	Cust.	1	1.9K		24×1	LCD		24×1	C	5	●						●		Cassette	Ba		T4	Single-line display
Tandy TRS-80 Pocket Computer 2	£179	Cust.	1.3	2.6K	16K	26×1	LCD		156×7	C	6	●						●		Cassette	Ba		T4	Plotter available
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Televideo TS-800 Series	£1,495	Z80A	4	64K		80×24	M		80×24	W	15	●	2			1				CP/M		●	C11	Standard CP/M machine
Televideo TS 1602-C	£3,714	8088	5	128K	256K	80×24	M		576×424	W	15	●	2			1			2×256K5¼F	CP/M86		●	C11	Graphics, but no colour
Texas Instruments TI-99/4A	£150	9900	3.5	16K	52K	32×24	Tv(M+)	●	256×192	W						2		●		DOS	Ba	●	T5	This has sprite graphics
TI System 200-250	£6,695	9900	4	64K		80×24	M		80×24	W	12	●	1						1×5Mb5¼H	UCSD-P, PX10		●	T5	Bigger version available
TMK 332	£2,242	8085A	5	64K		80×24	M		190×96	W	22	●	2	1					2×320K5¼F	CP/M	Ba	●	P5	*6502 I/O processor
Torch	£3,214	Z80*	4/2	96K		80×30	TvM	●	640×256	W	15	●	1	1		4		●	2×400K5¼F	CPN	Ba	●	T6	CP/M compatible
Toshiba T-100	£1,900	Z80A	4	64K	96K	80×25	TvM	●	640×200	W	8	●	1	1	1		2		2×256K5¼F	CP/M	Ba	●	O4	Pro test March 18
Toshiba T-200	£2,242	8085	2.6	64K		80×24	M		80×24	W	15	●	1		1				2×256K5¼F	CP/M	Ba	●	O4	Standard CP/M machine
Transam Truscan	£1,983	Z80A	4	64K		80×24	TvM		640×288	W		●	2	1		1	5		2×190K5¼F	CP/M		●	T7	S-100 machine
Transtec BC2	£1,949	Z80A	4	64K	256K	80×24	M		80×24	W	13	●	2	1			8		2×386K5¼F	CP/M		●	T8	Fully definable characters
Vector 4	£3,852	8088	5	128K	256K	80×24	M	●	640×312	W	15	●	1	1		1	2		2×630K5¼F	CP/M, CP/M 86	Ba	●	A4	8-bit and pseudo 16-bit
Victor 9000	£2,754	8088	5	128K	896K	80×25	M		800×400	W	7	●	2	1			4		2×600K5¼F	CP/M 86, MS-DOS	Ba	●	D8	Same as Sirius 1
Wilkes YD8110	£4,025	8086	5	128K	896K	80×24	M	●	960×624	W	21	●		1			6		2×1.2Mb8F	CP/M 86	Ba	●	W2	Standard CP/M machine
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Zenith 120-22	£2,978	8088	5	128K	192K	80×25	M		640×225	W	18	●	2	1	1	1	5		2×320K5¼F	CP/M, MS-DOS, Z Basic		●	Z1	Graphics includes turtle
Zenith Z89-81	£1,668	Z80	2.5	48K	64K	80×24	M			W		●	2	1					1×100K5¼F	CP/M	Ba	●	Z1	Elderly CP/M machine
Zeus 4	£5,400	Z80	4	64K	320K	80×25	(M+)		80×25	W	11	●	10						1×6Mb5¼H+1×250K5¼F	CP/M, Muse	As	●	M5	Designed as multi-user

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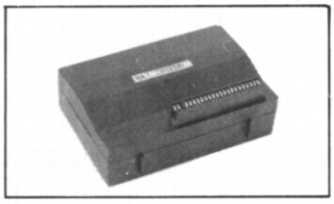

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